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OCTOBER 1953

Community Traffic
Rights of Way and Entrance
Pittsburgh's Parking Authority
Zoning Based on Loading Experience
Small-City Traffic Engineering Problems
Engineering Education for Transport Needs
Median Dividers for Urban Streets
Speed Limits in New Mexico
Correcting Traffic Difficulties
Police Traffic Training
The Democratic Way

THE ENO FOUNDATION FOR HIGHWAY TRAFFIC CONTROL

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Community Traffic

MANY communities in the nation today are "best known" for their cluttered, inefficient traffic conditions. Their bottlenecks, curb-parked thoroughfares, and poorly controlled driving characterize them above their natural beauty and historical interest.

In this country of economic supremacy and great distances, these delaying, hazardous areas annoy visitors. *Annoyed travellers warn others to stay away.* Moreover, bad traffic makes it difficult to reach markets and distribute products. While communities seek to attract interest and trade for growth and importance, their congestion hampers the street and highway transportation so essential to both trade *and* interest. Customer-slogans unavoidably become "Impossible traffic! Keep away!"

Such are far too many Main Streets. Every principle of good traffic management is grossly violated. Yet these conditions, when bluntly spelled out for citizens, meet indignant denial—mainly from those who contribute most to the choked and crawling travel.

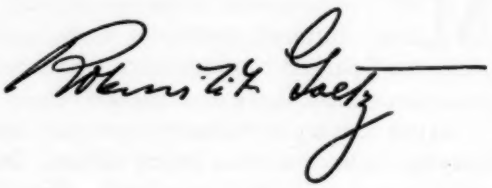
To the stranger in town, the confusion suggests official indifference, lack of civic interest. A visitor leaves the city with a feeling of relief, with a vow never to return if he can find a better way, and finally with a sense of commiseration for a traffic policeman officially designated to fit square traffic pegs into round municipal holes.

Such conditions are incompatible with good city government or public spirit. The widespread condition leaves either business traveller or tourist little choice between his home town and places he struggles through on his journeys. The experience merely adds to his dismay.

It leaves the homebody in frustration, wondering why nothing is done. While he has an innate desire to preserve the old charm of an area, he also observes that some communities get good and necessary things done while others go from bad to worse, including the charm.

These conditions have reached the limit of public toleration. National growth and progress must include efficient street as well as highway travel. Some communities know this, and know its grow-

ing importance in efficient civic administration. Towns and cities, large and small, to continue as our bulwark, must have progressive leadership.



Rights of Way and of Entrance For Highways on New Sites

JAMES HUTTON AND CLARENCE W. PHILLIPS

Mr. Phillips is Chief of the Federal-Aid and Rights-of-Way Branch, Legal Division, Bureau of Public Roads, and is Secretary of the Standing Committee on Administration of the American Association of State Highway Officials. He served as Commissioner of Highways and Public Works of the State of Tennessee from 1939 to 1949, and previously from 1927 to 1939, as Chairman of the Bedford County Highway Commission. In 1947 he served as President of the American Association of State Highway Officials.

Mr. Hutton is an attorney in the legal division of the Bureau of Public Roads, and author of a legal paper on the legal precedents approving restricted dedication of rights-of-way for special uses, published by the Highway Research Board.

THE travelling public in all American cities needs expressways and parking places to relieve over-crowded streets. But the expense of building expressways is great. One substantial part of the expense of expressways has been payment of damages to owners of land adjoining expressways on new sites for highways because the right of entrance from all roadside places was not given.

Claims of such damages are plausible only because confused with cases involving right of entrance into roads dedicated for local use with no restrictions on entrance at all points. The claims are not based on the legal principles applicable to special facilities designed for free-flowing traffic, and therefore are inequitable and should not be allowed.

The present article presents authorities and principles by which a restricted dedication may be made of sites on which highways subject to unlimited access did not exist previously, and liability may be avoided for not giving entrance from all roadside places directly into expressways.

Lest this argument, built up of legal abstraction on legal abstrac-

tion as to rights to use land for expressways versus claims to enter from all roadside points, seem unconnected with the pressing problems of traffic-frustrated people in American cities, attention is directed to the stupendous demands made of highway and transit facilities in cities, the jammed condition of streets caused by inadequate travel-ways and the function of expressways in affording a lifeline to cities submerged in seas of cars and buses, trucks and trains. When the scope and importance of these demands are seen, then the right of the people to have travel-ways on which to move efficiently the vast, tangled mass of cars which chokes existing streets will become interesting.

In a year approximately two billion passengers are carried in the New York subway, whence they enter the streets. Thus in a year the equivalent of the population of the whole world is carried by the transportation system of a single city. In Washington over half a billion persons use the transit system in a year, as compared with 1.8 billion in Paris, one-half billion in London, one-quarter billion in Moscow, 259 million in Pittsburgh and 240 million in Berlin.

In the United States as a whole almost one-half of the annual 485 billion vehicle-miles is piled up in cities. In a single day a million transit passengers enter Chicago. Across a single bridge at Philadelphia 21 million motor vehicles move in a year, of which a million are buses. In an economy of mass production by specialization of labor, concentration and mass movement of persons and goods go hand in hand, and the daily traffic cycle to and from every city and industrial beehive attests the fact. Hence the vital place of travel-ways in the American economy, not the least important of which is the expressway. (1). (Reference to notes on page 440).

But existing street systems do not permit efficient movement because they were designed for horses and wagons, were laid out at right angles to one another, and intersect at grade. The physical impossibility of moving motor vehicles at high speed around corners or through streams of other motor vehicles at street crossings as in the prevailing street pattern requires that the street pattern be changed by construction of expressways with a minimum of interfering traffic, the elevation or depression of heavily travelled streets, the progressive timing of red lights and the provision of parking

Photo by Smith Brothers, Detroit

Davison Highway, Detroit, Michigan.

Frontage Roads on Lee Boulevard, Arlington, Virginia.

space. (2) The expressway is a vital link in such travel-way network, and the power of controlling access thereto without prohibitive damage charges is the legal foundation of expressways designed to relieve the cities.

In the nature of things the planning and financing of rights-of-way for expressways and service roads must precede superimposing on the pattern of street grids a modern system of expressways with curves, access points and grade separations required by free-flowing motor traffic. One of the greatest impediments to the realization of desirable road improvements has often been the lack of adequate rights-of-way. Far too often it has been necessary to alter plans in order to make them fit the available right-of-way instead of providing a right-of-way adequate for the design and construction of a highway that will meet future traffic needs.

It is imperative that legal authority be secured and exercised to acquire and dedicate land for special travel-ways into which direct entrance from all roadside points is not tolerated. Likewise, advance planning of service road routes is imperative. Acquisition and dedication of rights-of-way for future expansion of urban communities will avoid heavy property costs incident to condemnation of property after buildings have been placed within lines needed for highways.

The transportation system is the framework upon which land use and development are based, and the sooner it is found to be practicable to plan routes adapted to the development of urban areas the sooner more rational development may begin in residential, commercial and industrial sections of cities. Foresight and action in planning rights-of-way will prevent functional obsolescence in short periods and the necessity of duplicating facilities now being built.

Advance planning and restricted dedication of rights-of-way for expressways and service roads are more difficult and more important than any other phase of urban transportation because of the complexity of cost factors and economic and traffic demand in city areas. Selection of expressway-system sites is nevertheless the key to the problem of the urban traffic maze, and legal power to make this selection unfettered with prohibitive damages for not giving entrance from all points beside the expressway on new location is the

core of the right of the public to have expressway systems designed to serve both in name and fact as urban travel-ways, instead of stop-and-start-ways.

What Is the Function of the Expressway?

The expressway grew out of pressing actual need. The construction of the modern expressway was suggested in the 1930's (3) and it has been designed for through-traffic to relieve the congestion of big city areas, and to promote efficient mass movement of persons and commodities in our economy of specialization of labor and mass production. (4) Because many cities are too big for their streets traffic is congested at the hours of peak travel and delay in the streets wastes time, increases transportation costs, reduces business profits, depresses the value of taxable land, and wipes out the savings of efficiency in other parts of the economic system. (5) So, the expressway was designed as a special street dedicated to the use of the public in uninterrupted travel. For local traffic entering the expressway special connections with service roads have been designed so as not to permit cars entering the expressway to halt the continuous movement in the main traffic channel of the expressway.

Thirty-one states have authorized construction of expressways, sometimes designated as thruways, freeways, or limited access highways. (6) Some examples of this answer of the big cities and the states to the challenge of snarled traffic are the Pennsylvania Turnpike, extending from a point near Philadelphia to the Pennsylvania-Ohio boundary, the New Jersey Turnpike, extending from a point near New York City across the state to New Castle, a place on Delaware Bay, the half-billion dollar New York Thruway, under construction from New York City to Buffalo, and the proposed Los Angeles network of expressways comprising approximately 350 miles, at an estimated cost of a half-billion to connect the forty communities near Los Angeles. (7)

For the modernization and rehabilitation of the big city in America an expressway system is required whenever the saving of time to the public is commensurate with the costs of construction and of rights-of-way. An expressway alone is not enough: both ex-

pressway and parking and terminal facilities having a capacity equal to traffic demand and located on the desired lines of travel, and the due use of local streets are required for the solution of the big-city traffic problem. (8)

In smaller cities and towns, elevated or depressed streets which eliminate intersections at the same level on heavily travelled sections would make travel easier and safer. The ability and willingness of the public to bear the expense in such cases will determine whether the desirable facilities are practicable.

Inequitable Demands of Abutters

Heavy costs of expressway rights-of-way have been increased by the demands of indemnity by owners of land adjoining expressways located at places where no street existed before and to which no access rights had been acquired, because driveways or entrances were not permitted into the expressway at all points. Some courts have approved the demand, as if the expressway were not a special street for special purposes, including the denial of unlimited access, and as if it were a common-law street or highway to which by implication of law unlimited access from all roadside places is given. The consequences of paying the indemnity would be to render expressways on new location as expensive as those on streets into which each owner of adjoining property had the right of direct entrance, an expense comparable to the value of the entire property in developed sections where no other means of access exists and the street is converted into an expressway.

Consequently, the avoidance, consistent with law and natural justice, of paying damages for not giving free entrance to expressways at all points will promote the economical construction of expressways and so will aid the modernization of the great cities and their adaptation to modern transportation, the expansion of suburbs and of living space within the cities, and hence a better mode of life. These are the stakes involved in the legal problem of dedicating expressway rights-of-way to special uses and of controlling access at the lowest cost justly owed. (9)

In one of the leading cases in Minnesota on the subject, *Burnquist*

v. *Cook* (1945) Sup. Ct. Minn., 19 NW 2d 394, the Court took the position that the state conferred a legal right of entry into an expressway on new location the moment the expressway was opened to the public and that this right of entry could only be terminated by paying from public funds the value of the right. In this case the expressway was built on land acquired from a single owner but no part of the expressway involved in the case was placed on land of the owner of the adjoining property.

The Court held that easements of access were created and became appurtenant to the land adjoining the expressway when the expressway was established. That this was contrary to the intention of the planners of the highway appeared from the fact that the easement of access from the land out of which the expressway was carved was explicitly extinguished. Why the law should imply a grant of access rights from the other side of the same expressway, and should require payment of public funds to extinguish the implied right of entrance under these circumstances seems so inexplicable as to suggest error on the part of the Court. But the Supreme Court of Missouri took a similar position in the case of *State* v. *James,* (1947) 205 SW 2d 534, 537, over objection of Mr. Wilkie Cunnyngham, counsel for the state. The writers of this article denied that the ruling in *Burnquist* v. *Cook* is valid as a precedent and landmark on abutter's right of entry to expressways on new sites. (10) Subsequently, a leading case contra to *Burnquist* v. *Cook* was decided by the Supreme Court of California, *Schnider* v. *State of California* (1952), 241 P. 2d 1, with which *People* v. *Thomas* (1952) Calif. Dist. Ct. App., 239 Pac. 2d 914, is in accord. Further in the same line of development, the State of Oregon, with the advice and leadership of the late Mr. J. M. Devers, of the Oregon State Highway Commission, enacted a statute, Chapter 587, Laws, 1951, protecting the state against the demands of abutting landowners for not being permitted to enter at will expressways and other highways on new sites. (11)

A review of the above-mentioned developments in recent legal history relating to expressways, an exposition of the principles involved, and a summary of legitimate methods of implementing the principles and protecting the states against the inequitable demands of abutters for indemnity are undertaken in this article as a con-

Courtesy Texas Highway Department

Central Expressway, Dallas, Texas

East Shore Freeway, Los Angeles, from Fifth Avenue overhead.

tribution to literature used by highway agencies responsible for the free movement of traffic in cities.

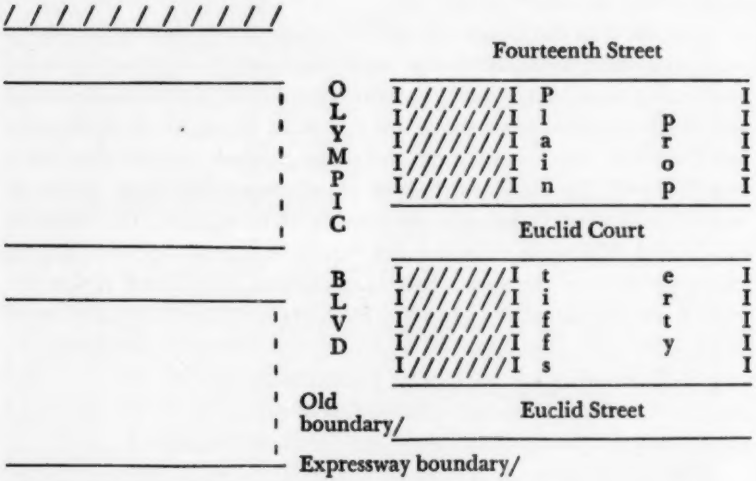
Proposition of Law

A restricted dedication of land for an expressway or other limited access facility on new site or right-of-way for highways affords the needed instrumentality to control or deny access to such expressway or facility without laying the state, or its local subdivisions, liable in damages for not permitting entrance to the expressway or other facility dedicated for special use.

The facts in the California case of *Schnider* v. *State* were that in 1945 the state authorized the widening and reconstruction of a boulevard as an expressway, or limited freeway. Two lots adjoining the boulevard were acquired by the state in order to widen the boulevard at that point, and the state erected a fence along the boundary of the boulevard after it was widened. The plaintiffs owned the property beyond the fence which adjoined the widened boulevard. No right to enter the boulevard from the side of the property next to the fence had ever existed, but access rights did exist from the plaintiff's property fronting on streets which entered the boulevard. The fence barred direct access from the property to the widened boulevard. The plaintiffs demanded but the trial court refused to grant damages for loss of an asserted right of direct access into the boulevard from the adjoining property.

The Court held on appeal that no right to enter the boulevard existed at the time the state authorized conversion of the boulevard into an expressway, no right to enter the expressway arose upon the acquisition of the property between the old boulevard and the plaintiff's land across the boundary of the new expressway, and that no right of entering the expressway was acquired as a result of the construction of the expressway, or freeway. "Freeways are designed to provide rapid transit for through-traffic, uninterrupted by vehicles or pedestrians from private roads and intersecting streets, and the word 'freeway' as used in the Streets and Highways Code, means a highway with respect to which owners of abutting lands have no rights of access or only limited rights of access."

"The provision of Section 100.3 that a declaration creating a freeway 'shall not affect private property rights of access, and any such rights taken or damaged within the meaning of Article I, section 14, of the State constitution . . . shall be acquired in a manner provided by law,' plainly refers to rights of access which exist PRIOR TO THE ESTABLISHMENT OF THE FREEWAY AND NOT TO CLAIMED RIGHTS WHICH HAVE HAD NO PREVIOUS EXISTENCE AND WHICH COULD COME INTO EXISTENCE, IF AT ALL, ONLY BY VIRTUE OF THE NEW CONSTRUCTION." (Capitals added.)



"Where a property owner has no right of direct access to a highway before it is converted into a freeway abutting upon his property, nothing is taken from him by the failure to give him such a right when the conversion takes place. THE ALLOWANCE OF COMPENSATION IN SUCH A CASE WOULD AMOUNT TO A GIFT RATHER THAN PAYMENT FOR THE DESTRUCTION OF A RIGHT. . . . The construction of the freeway, pursuant to the resolution, did not create new rights of access in favor of land which did not abut upon the highway as it formerly existed. When an ordinary or conventional road is built there may be an intent to serve abutting owners, but when a free-

way is established the intent is just the opposite, and a resolution creating a freeway gives adequate notice THAT NO NEW RIGHTS OF ACCESS WILL ARISE UNLESS THEY ARE SPECIFICALLY GRANTED." (Capitals added.) *Schnider* v. *State* (1952) Supreme Court of California, 38 A. C. 492, 241 Pac. 2d 1.

In another California decision, *People* v. *Thomas* (1952), District Court of Appeal, Fourth District, California, 239 Pac. 2d 914, an entire parcel of land was taken for the purpose of constructing a new limited access freeway. The part taken was Parcel 4, also designated Parcel C, consisting of 6.8 acres, owned by a Mr. Thomas, and was part of 912 acres of ranch land. The new freeway cut across Parcel 4 in an east-west direction, and a triangular tract of two acres was left north of the boundary of the new right-of-way and a strip 50 feet wide was left south of it. The owner of this parcel complained on appeal because the trial court instructed that no damage was owed for severance of access rights by the taking of Parcel 4, and that the jury should not consider that the remaining acreage at any time had ingress and egress rights to the new freeway. The appellate Court held that the instruction was correct, and said:

> The evidence shows that no highway existed in the location of Parcel 4 prior to the construction of the freeway and it is apparent that appellants never had an existing easement of access to State highway road VIII–Riv–77–E, or any other highway and since no property right was acquired, they have no supportable claim for damages. A "freeway" is defined as a highway in respect of which owners of abutting lands have no right or easement of access to or from their abutting lands or in respect to which such owners have only limited or restricted right or easement of access. Sec. 23.5 Streets and Highways Code. The resolution passed by the highway commission did not create in appellant's property a new right of access to a freeway to be constructed where no highway, conventional or otherwise, existed before. *City of Los Angeles* v. *Geiger*, 94 Cal. App. 2d 180, 210 P. 2d 717. As was there said, 94 Cal. App. 2d at page 191, 210 P. 2d at page 724: "There can be no detriment to a right which never existed and no compensation for a loss not sustained. The construction of the freeway extension did not cause defendants to lose an easement for access to Cahuenga Boulevard since it had never been acquired. Manifestly plaintiff cannot be required to pay damages for injury to a non-existent right or for a mere hope, surmise . . . or expectancy that a right might possibly be obtained in the future, *Colusa and Hamilton R. Co.* v. *Leonard*, 176 Cal. 109, 125–127, 167 P. 878 . . . ."

Discussion of Controlling Legal Principles

Highways are public property (12) title to which is in the state for the benefit of all the public for purposes of that kind of travel expressly or by implication specified in the dedication of the property for said uses. The familiar uses of highways for travel on foot and by vehicles are not the exclusive or invariable types in this branch of the law dealing with property used for purposes of travel. Public rights-of-way were created by dedication by the owner and acceptance by the public authorities. A landowner might make a conditional dedication of a right-of-way to the public with reservations and restrictions as to its use. Land might be and frequently was dedicated as a footpath, (13) or a bridleway, or a carriageway, or a driftway (14), a churchway (15), a towpath (16); and, under modern statutes (17), special roads have been dedicated for fast, through-motor traffic. Such dedications were instances of restricted dedication for special uses.

The legal doctrine at common law was that the right of the public in the land used for highways was in the nature of an easement, although it differed from a technical easement in that there was no dominant tenement (18), and easements in gross (i.e., for uses of a class of persons without being tied to the land owned by such persons) were not recognized at law in the English courts. Chesire, "Modern Real Property," 6th ed., p. 216. The owner of the land surrendered the land for the uses incident to highway travel but retained all rights therein, the enjoyment of which was consistent with the use of the highway by the general public, such as the right to minerals under the land; and upon discontinuance or abandonment of the highway the right to possession of the land formerly used for the highway returned to the owner or his heirs who had dedicated or surrendered the same for highway use (19).

The owner of the land adjoining a public highway also retained the right to enter the highway located on his land at all points, as if he had never parted with any interest in it (20). It seems clear that in the long ago the right of the owner of adjoining property to enter the highway from his own land did not interfere with and was consistent with its use by means of horse-drawn vehicles or by pedes-

trians. The easement of the abutting landowner to enter the highway and use it for the benefit of his private property is widely prevalent today. This easement originated in the reservation by the landowner in dedicating land for pubiic highways, of his right to use the land consistently with public use, and, in those states in which the title of highways in fee simple is in the state, the easement was given by implication, and the same result was reached as in cases in which the reversionary title remained in the abutter subject to the right of possession and use of the public for highway purposes (21).

The principle in the English law of the holding of property in trust for designated beneficiaries under specified conditions as to use is the same as that in the laws defining the rights and privileges of using land dedicated for highways (22). The subject property is held by the state as trustee for the general public, and the uses to which the property may be put are defined in the statute and case law relating to highways. In consonance with the underlying principles, the statutes of the 31 American states and of England defining the uses to which expressway rights-of-way may be put stipulate that the property is to be used *for* free-flowing traffic, unchecked by cross currents of cars from frequent intersections and roadside entrances, and that the property is *not* to be used *for* the convenience of owners of abutting property save as they may enter by *service roads* connected with the expressway at special interchanges and ramps designed to reduce to a minimum the interference of merging traffic.

Therefore, it follows from the purpose and terms of the dedication of expressway rights-of-way for the special use of free-flowing traffic that not only is no implied easement of unlimited access vested in the abutter but by necessary implication and by explicit language unlimited access by abutters is forbidden, that no property right vests in the abutter when an expressway is dedicated on a location not previously used for an unlimited access highway, and that no damages may be collected from the state by the abutter because he is not given the privilege of free entrance into the expressway at all points, but, like other members of the general public, must enter the expressway at the special ramps and interchanges via service roads leading thereto from his property. It is not the policy of the

law to give unlimited access to expressways, and neither is it the policy of the state as enacted into law to isolate and destroy the property in the vicinity of the expressways, as is shown by the policy of providing service roads wherever in the sound discretion of the highway officials this is found to be practicable.

Court decisions recognize the power of private persons and of cities and states to dedicate land for highways under the conditions restricting the use of the new highway which were stipulated when the highway was established. Some of the conditions deny access by abutters on foot and by vehicle, some exclude access by abutters and others using vehicles and permit pedestrian use only. Other conditions exclude loaded vehicles, permit winter travel only, forbid turning to the left except at designated places, etc.[1]

The point of interest is that the abutter receives or reserves no grant of unlimited access, and the cases have held he is entitled neither to damages nor an injunction, when access is restricted by the conditions of the original dedication of the highway. We repeat, this power to restrict access at the dedication of a highway, approved by public officers and courts accepting for the public the restricted dedication, affords a legal instrumentality for controlling access to expressways and limited access facilities without liability in damages to owners of abutting land; and the use of the power to restrict

1 Four streets in Central Park from 5th to 8th Avenues in New York City, constructed in the latter part of the 19th century, were depressed roadways, had stone retaining walls on both sides, and were crossed with stone bridges for the accommodation of roads through the park. These roads are examples of controlled access highways and of highway-grade separations. "Roads and Streets," February 1947, p. 103. Tiffany, "Real Property," 3rd ed. Sec. 1111; 8 Ruling Case Law 909; 2 Dillon, "Municipal Corporations," 4th ed., Sec. 656; *Home Laundry Co.* v. *City of Louisville* (1916) Ct. of App., Ky., 182 SW 645; *Stegman* v. *City of Fort Worth* (1938) Ct. App. Ky., 116 SW 2d 649; *Attorney General and Newton Abbott Rural District Council* v. *Dyer* (1947) Chan. Div. High Ct. Justice, (Eng.) 1 Chan. 67; *Huey* v. *Whitley* (1929) Chan. Div. Sup. Jud. Ct., (Eng.) 1 Ch. 440; *Tyler* v. *Sturdy* (1871) Sup. Jud. Ct. Mass., 108 Mass. 196; *Abrey* v. *Livingstone et al., Park Com'rs* (1893) Sup. Ct. Mich., 95 Mich. 181, 54 NW 714; *Ferguson Seed Farms* v. *Fort Worth etc. Ry. Co.* (1943) Ct. Civil App. Tex., 69 SW 2d 223; *Woodyer* v. *Hadden* (1813) Ct. Common Pleas, 5 Taunt 125, 128 Eng. Rep. 634; *City of Atlanta* v. *West* (1939) Ct. App. Ga., 3 SE 2d 755; *Cityco Realty Co.* v. *Slayman* (1931) Md. Ct. App., 160 Md. 357, 153 Atl. 278, 76 A.L.R. 269; *Berridge* v. *Ward* (1860 Nisi Prius, England, 2 F. & F. 208, 175 Eng. Rep. 1026; *Jones Beach Blvd. Est.* v. *Moses* (1935) N.Y. Ct. App. 197 NE 313; *Hughes* v. *Bingham* (1892) N.Y. Ct. App., 32 NE. 78; *Atlantic City* v. *Associated Realties Corp.* (1908) 73 N.J.E. 721, 70 Atl. 345; *Illinois Malleable Iron Co.* v. *Com'rs of Lincoln Park* (1914) Sup. Ct. Ill., 105 NE 336; *Atlantic City* v. *Atlantic City Steel Pier Co.* (1901) Ct. Chan. N.J., 49 Atl. 822; *Judd* v. *Challoux* (1944) Sup. Ct. Vt., 114 Vt. 1, 39 Atl. 2d 357.

abutter's access to expressways and limited access facilities is in harmony with the long-established doctrines of easements exemplified in precedents heretofore discussed. Traffic engineers and administrators may be interested in the decisions and authorities relied on to prove that access to expressways and other limited access facilities on new locations may be restricted at dedication of the facilities without liability in damages.

Implementation

To establish a highway whose use is restricted (so as to prevent giving to abutters the right of unlimited access to the new road, and to avoid having to pay when no right of access is given), an express provision limiting the use of a highway may be inserted in the deed of land purchased (23) or in the statutes authorizing the opening of new highways and condemnation therefor. The statutes of such states as New York and Virginia upon the establishment of limited access roads authorize payment for *existing* easements, and the law of New York expressly forbids creation of liability not already existing by law. These statutes may be applied to the case of a new highway dedicated from the beginning as a limited access highway, and payment would not be required for taking the abutter's right of access, since no such right was ever given, under such construction. To avoid the labor of explaining the analysis of abutter's easements in existing highways and the legal basis thereof, it would be advisable to amend the limited access statutes by adding a clause that the new highways established thereunder shall be so dedicated as not to be subject to access by abutters, except at points designated by the highway authorities.

Where existing statutes do not protect the public from liability for not giving access to the owners of land that abuts on new expressways on lands upon which no highway previously existed, such statutes should be appropriately amended to safeguard the interests of the public in this respect. It is suggested, therefore, that the state highway departments take cognizance of this important matter so that their legal advisers may consider and determine whether the existing statutes of their states should be amended.

Also, it is suggested that any new legislation to authorize the construction of expressways in any state not now having such legislation should include appropriate provision for the protection of the public from liability for not giving access to the owners of land that abuts on such new expressways on lands upon which no highway previously existed. Such provision, whether for an amendment of existing legislation or as part of new legislation, with appropriate changes in language to insure consistency of terminology and purpose, should be, in substance, as follows:

No easement of access to or from expressways (or like limited access facilities) constructed on location to which access rights have not existed previously shall be created for the benefit of abutting land by the dedication of such expressways (or other like facilities) pursuant to the statutes applicable thereto except at such controlled points as shall be approved in writing or established for access by the agency having administrative control of such expressways (or other like facilities).[2]

It is believed that it would be held judicially under such provision that the owners of such abutting land would not be entitled to receive any compensation for not being given access to or from such expressways (or other like facilities) at other than such controlled points,[3] and that in determining the compensation to be paid for taking any land or interest therein for such expressways (or other like facilities) the value of the land or interest therein taken and the diminished value of land from which land taken has been severed, if any, would constitute full compensation, without any allowance for not having access to or from such expressways (or other like facilities) at other than such controlled points. (24)

In states wherein only easements are acquired for highways, courts having jurisdiction over eminent domain proceedings should be empowered to take and award such an estate, or interest less than

[2] *United States* v. *Willow River Power Co.* (1944) 324 U.S. 499.

[3] In consequence of not creating a property right of access no damages are due when enjoyment of access is denied. *Sauer* v. *N.Y.* (1907) Sup. Ct. U.S., 206 U.S. 536. Compare the following statute: "After the designation of a controlled-access highway, the owners or occupants of abutting lands shall have no right or easement of access, by reason of the fact that their property abuts on the controlled-access highway or for other reason, except only the controlled right of access and of light, air or view." Section 84.25(6), Chapter 492, Laws of Wisconsin, 1948–1949.

the fee, as will give the state the right of possession and use of lands condemned for expressways, or other limited access facilities, and exclude access thereto from abutting land except at controlled points approved in writing or established by the agency of the state in control of such expressways, or other like facilities.[4]

The central point of this argument relates to the dedication and establishment of highways subject to restriction of access by abutters to controlled points provided for that purpose. Such restricted dedication requires that the state have, through its agencies or political subdivisions, a right to possession and use of the land on which expressways are to be constructed. Likewise, voluntary conveyances should include the right of possession and use of the land conveyed together with a limitation of access by the abutter to such controlled points as may be provided for that purpose. To enable the state to dedicate a highway of any kind at a new location subject to a prohibition of access from abutting land, the state must have a right to the exclusive possession of the land to be dedicated, and the officers of the state who are authorized to dedicate a new highway must be given power to impose the restriction and must impose it in fact.

The process will be clear from doubt if the restriction is imposed in explicit language, and is not left to implication. In states in which unrestricted highways are located on lands owned in fee simple by abutting landowners subject to rights-of-way of the general public in the nature of easements, in order for the state to have the ownership of an interest in the land which would enable it to impose a restriction against abutters' access thereto the state would have to acquire a right of exclusive possession. When such interest is acquired, then the state in dedicating the highway facility constructed on such land may reserve and restrict the expressway or other facility so that abutters have no access rights, and may dedicate the facility for free-flowing traffic without interference from cross-currents of traffic. The purpose of the suggested statutory amendment, above, is to secure the requisite dominion over the land which would entitle

[4] See *Troy & B. R. R. Co.* v. *Potter* (1896) 42 Vt. 265, 1 Am. Rep. 325; *Atlanta & W. P. R. Co.* v. *Atlanta B. & A. R. Co.* (1906) Sup. Ct. Ga., 54 S.E. 736; *Midland Valley R. Co.* v. *Sutter* (1928) C.C.A. 8th, 28 Fed. 2d 163, certiorari dismissed 280 U.S. 521; 155 A.L.R. 393, ann., holding the type of easement held by a railway company in its right-of-way gives exclusive possession as against abutting landowners.

the state to specify the uses to which it may be put when opened to the public.[5]

The effect of the foregoing statutory amendments would be to prevent the vesting of the easement of access from abutting lands to expressways located on new routes or segments of routes. This is considered preferable to the procedure of vesting such rights and then extinguishing the same. It has been suggested that only nominal damages need be paid where the right is vested and then extinguished, but no assurance may be had that vested property rights of access to a highway have generally only nominal value.

The contrary appears to be the case. (*U. S.* v. *Welch* (1909) U. S. Sup. Ct. 217 U. S. 332, 54 L. Ed. 787, per Holmes; *Re West Tenth St., Borough of Brooklyn* v. *West Tenth Street Realty Corp.* (1935) N. Y. Ct. App., 196 NE 30, 98 A.L.R. 634; *Town of Stamford* v. *Vuono* (1928) Sup. Ct. of Errors of Conn., 143 Atl. 245.) If there exists an easement to a highway to be constructed in future and if such easement is a property right which must be extinguished before an expressway can be established, then such easement would have to be paid for according to its value to the dominant tenement, just as other vested property rights whose actual enjoyment is in the future must be paid for. (See Sec. 233, vol. 18, p. 867, "Eminent Domain," and "Life Tenants and Remaindermen," American Jurisprudence; Simes "Law of Future Interests" Sections 612, 613, 616(d).) However, it is not believed that in law any easement of access exists prior to the dedication of a highway. (25) All that exists is the right of a landowner to go from one part of his land to another on which no highway has been constructed. All that is necessary in buying or condemning the land on which a limited access highway is to be placed is to secure a right to exclusive possession of the land.

In no accurate use of language can this last be said to be an extinguishment of access rights to a highway, for such rights are created only when the highway is dedicated. All easements are the effects of grants, and the abutter's easement of access to a highway is no exception, since the effect has no existence prior to its cause. Questions relating to adverse use and possession of highways as expressways are

[5] Compare Sec. 48–350, Wyoming Comp. Stat., 1945, providing for the taking of a fee simple title for expressways. In accord: Vol. VII, Sec. 100–1207, Oregon Comp. Laws Ann.

outside the scope of this essay, but such adverse use would imply the rights in expressways as established and defined in the statutes and decisions of a state in which such expressway may be located.

Conclusion

Unless (by judicial construction of statutes, as in the *Schnider Case,* or by express amendment of statutes authorizing establishment and restricted dedication of expressways) access by abutters is restricted so that there is given the abutter no vested right of access to new expressways, millions of dollars of highway funds will have to be paid to buy back the unearned increments accruing to owners of lands abutting on new expressways. Such a result is unconscionable. But recognition by judicial decision of the legal power of restricting the dedication of expressways so as to prevent the vesting of unlimited access rights in abutters, or the enactment of statutes expressly conferring such power of restricting access to expressways at dedication, and the reasonable use of this legal power will reduce the expense of building expressways to relieve traffic congestion and will promote all the economic and social interests which depend upon adequate highway systems.

Relief of congestion and saving of time in delivery of goods and local and long-distance travel of people are not ends in themselves but are vitally connected with the health, productivity, prosperity and happiness of the people of American cities. For the value of business centers, the usefulness of land for industry or residence depend on accessibility of transportation. The blockade of cities by hordes of cars and trucks jammed in inadequate streets is a disaster comparable to the economic effects of a blockade by armed forces employing roadblocks, mines, tanks and machine guns.

The reclamation of blighted areas in cities, the utilization of potential areas of development, the coordination of housing, industrial, commercial, recreational, and street development in cities *demand voluntary cooperation by property owners with public authorities in laying out channels of travel and planning points of entry into expressways,* so that the orderly development of cities may proceed by the processes of local self-government, free enterprise,

and governmental action responsive to the will of the governed, and may avoid the arbitrary use of governmental power or social regimentation. If the owners of business, industrial and residential property know where adequate facilities for fast traffic will be placed, where the service roads will be placed, and where the residential areas may be placed, or rebuilt, and where parking areas will be provided, then long-range planning will be possible, which will take away the blighting effects of inadequate traffic facilities, the loss of property value from traffic strangulation, and the overcrowding of the existing systems.

The requirement of providing parking space or bus and truck terminals adequate for proposed businesses will check development in excess of the capacity of street facilities. It is believed that property owners and investors would be guided by these factors, and would build and expand cities in accordance with the capacity of a well-planned system of streets, limited access thruways or expressways, parking and terminal facilities.

But the process of planning is absolutely dependent upon the legal right of controlling access on the expressways and upon the fiscal ability of cities to obtain expressway rights-of-way at reasonable costs.

In sum, the expressway as thus planned is the lifeline of the business centers and suburbs in integrating metropolitan trade areas by means of efficient transportation systems, and its availability depends on the legal right to control access and to secure rights-of-way for the purpose at fair costs.[6]

NOTES

(1) "Mass Transportation," September 1952, p. 52.

(2) Annual Report, Bureau of Public Roads, 1947, p. 9.

(3) "Planning the Modern City," by H. M. Lewis, Vol. I, p. 147; "Traffic Engineering Functions and Administration," pub. by Public Administration Service, Chicago (1948), p. 82.

(4) "The legislative purpose is the establishment of limited access highways especially designed for through traffic." *Department of Public Works and Buildings* v. *Lauter* (1953), Sup. Ct. Ill., 110 N.E. 2d 179, 183; "Economics of Transportation," M. L. Fair and Ernest W. Williams Jr. (1950), p. 86.

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[6] "Controlled Access Expressways in Urban Areas," Highway Research Board Bulletin No. 25, p. 41.

(5) Countless hours of multitudes of people have been lost by delay on streets and highways. For example, origin destination studies show that on one street in St. Paul, Minnesota, 39 percent of travel time was lost by delay at intersections and within blocks, and in Spokane, Washington, 53 percent. "For years working people have struggled for a 40-hour week, and yet the average city worker is compelled to throw away from 10 to 15 additional hours per week to get to his work." Walter J. Mattison, "Virginia Law Review," November 1950, p. 870.

It was estimated that on the 4-mile Houston Expressway in 20 months the value of time saved equalled one-half the construction cost of the Expressway, viz., 3 million hours, a money saving of $4.7 million. Annual Report, Bureau of Public Roads, 1950, p. 14.

Traffic congestion and delay are major factors in driving people to the suburbs, in reducing business profits, in reducing the value of property in cities and decreasing the taxable value of property in cities, while the demands for municipal services over a wider area increase. Falling land values in turn are a major factor in causing blighted areas and slums, said to approximate 20 percent of all residential and commercial areas in large cities. In a group of large cities the blighted areas paid only 6 percent of the city realty taxes but required 45 percent of the cost of municipal services. General Philip B. Fleming, Administrator, Federal Works Agency, Jan. 11, 1945, Hearings of Senate Sub-committee on Housing and Urban Development, p. 1525; "Planning the Modern City," H. M. Lewis, Vol. II, pp. 17, 33, 35; "Controlled Access Expressways in Urban Areas," Highway Research Bulletin No. 25, p. 24; "Traffic Engineering Functions and Administration" by Joint Committee on Street and Highway Engineering Functions and Administration, A.A.S.H.O., Am. Pub. Wks. Ass'n, Inst. Traffic Eng'rs (1948), Public Administration Service, Chicago, pp. v, 3, 19.

(6) Cal., Deering's Code, 1945, Streets & Highways Code, Secs. 100.1, 100.3.
Colo., Colo. Stat. Ann., 1935, Vol. 4, Cum. Supp., Ch. 143, Art. 14, Secs. 144–153, as amended.
Conn., Gen. Stat., 1945 Supp. Tit. XI, Ch. 80, Pt. II, Sec. 351–h.
Fla., Ann. Stat. 1943, Vol. 13, 1945 Cum. Supp., Ch. 348, Sec. 348.03.
Ga., Tit. 95, Sec. 95-730–a, Laws 1952, p. 430, 442.
Ill., Smith-Hurd Ann. Stat., 1936, 1945 Cum. Supp. Ch. 121, Sec. 335.
Ind., Burns Stat. Ann., 1933, 1945 Cum. Supp. Tit. 36, Ch. 31, Sec. 36–3103.
Kan., S.B. 121, 1953.
Ky., Rev. Stat. 1944, Ch. 177, Sec. 3, Baldwin's ed. 1946.
La., Gen. Stat. 1944, Tit. 27, Ch. 1, 1946 Sup., Sec. 3609.14a.
Me., Rev. Stat. 1944, Tit. II, Ch. 20, Sec. 75.
Md., Ann. Code, Pub. Gen. Laws, 1943 Supp., Art. 89B, Sec. 150.
Mass., Ann. Laws, 1945, Ch. 81, Sec. 7C.

Mich., Ann. Stat. 1935, Cum. Supp. 1945, Ch. 68, Sec. 9.1094.
Minn., Burnquist v. Cook, 19 N.W. 2d 394.
Mo., St. v. James, 205 S.W. 2d 534.
N. H., Laws 1945, Ch. 188, Sec. 4.
N. J., Ann. Stat. Perm. Ed., Tit. 27, 1945 Cum. Supp. Ch. 7A, Sec. 27:7A–2.
N. M., Stat. 1941, 1945 Cum. Supp., Sec. 58–1002.
N.Y., McKinney's Consol. Laws, Bk. 24, Highway Law 1936, Cum. Sup. 1946, Sec. 29, Art. III, and Sec. 346, Art. XII–A.
O., Page's Gen. Code, 1945 Cum. Supp., Tit. III, Ch. 18, Secs. 1178, 7464–2.
Okla., Ann. Stat., Tit. 69, 1945 Cum. Supp., Sec. 11.3.
Ore., Comp. Laws, Vol. 7, Sec. 100–1204.
Penn., Purdon's Stat. Ann., Tit. 36, 1945 Supp. Sec. 2391.2.
R. I., Gen. Laws 1938, Tit. X, Ch. 75.
Tex., Vernon's Ann. Rev. Civil Stat., 1942, Tit. 28, 1946 Supp., Art. 1085a, Sec. 3.
Utah, Ann. Code 1943, Vol. 2, 1945 Cum. Supp., Ch. 10, Sec. 36–10–2.
Va., Code 1942, Tit. 18, Ch. 83, Ch. 209, Laws 1950, Sec. 1975yy(2).
Wash., Rev. Code, Sec. 47.52011.
Wis., Laws 1949, Ch. 492, Sec. 84.25.
Wyo., Comp. Stat. Sec. 48–348.

(7) In order to save the time of millions of people in entering and leaving the great cities every day the large scale program of expressways now in progress in the principal American cities is of prime importance. "Nearly all the 2,000 cities having a population of 5,000 or more have been incorporated in about 1,600 urban areas approved in accordance with the Federal legislation." (Annual Report, Bureau of Public Roads, 1950, p. 8.) In 1952, "the continued increase in travel produced its most pronounced effect in urban areas, since approximately half of all motor-vehicle travel is on city streets. Based on counts made in 41 cities, it was estimated that 1951 travel in urban areas was 6 percent greater than in 1950 and 45 percent greater than in 1941. Every city struggled with problems of congestion, delay and accidents. For some years there has been general acceptance of the fact that free movement of traffic can be accomplished only through provision of freeways for the largest streams of traffic, improvement of distributor streets, and creation of parking facilities and terminal facilities for trucks and buses. Activity toward these ends was greater than in previous years. Practically every city had major highway projects under way and was attacking the parking and terminal problems with greater energy than in past years." (Annual Report, Bureau of Public Roads, 1952, p. 6.)

In 1952 1,000 miles of urban Federal aid projects were approved, to cost over 700 million dollars. Sixty-five percent of this sum was for expressways,

14 percent for multilane, divided highways, 12 percent for additional lanes, 8 percent for removing hazards of railway-highway grade crossings, and less than 1 percent for minor improvements of existing highways. (Annual Report, Bureau of Public Roads, 1952, p. 7).

Since World War II (for fiscal years 1946–1955) one billion, one hundred and twenty-five million dollars have been authorized as Federal-aid, urban funds. One thousand, eight hundred and eighty-four projects financed from Federal aid urban funds have been completed since World War II, at a cost of $855 million and thereby 1,296 miles of improved urban highways have been provided. In addition, primary Federal aid system funds have been used in cities. Combining the urban and primary system funds, a total of 3,528 urban highway projects have been programmed for construction, involving 4,827 miles of highways, of which 3,762 miles have been completed, and 1,065 miles are in active construction projects. ("Progress of the Federal Aid Urban Highway Program," by C. D. Curtiss and R. W. Kruser, Bureau of Public Roads, April 1953.)

Many American cities are building expressways to save the time of the travelling public in big city areas. In addition to those mentioned, the following cities have begun large expressway programs: San Francisco, Detroit, St. Louis, Atlanta, Dallas, Houston, New Orleans, Pittsburgh, Denver, New Haven, Seattle, Trenton, Cincinnati, Kansas City, Plymouth, Cleveland, Philadelphia, Milwaukee, and Baltimore.

(8) "About two-thirds of the Federal aid primary and secondary systems are deficient in some respect and do not give satisfactory service to traffic." "Finding an adequate solution of highway traffic difficulties continued to be one of the unsolved problems of the nation." (Annual Report, Bureau of Public Roads, p. 1, 1952, the final year in office of Commissioner Thomas H. MacDonald.)

The expressway program is one of the essentials in the solution of the national urban traffic problem.

The Federal Bureau of Public Roads has taken the position that "Traffic congestion in cities will be relieved only by a broad attack embodying improvements such as:

"1. The construction of new arterial routes and the improvement of existing ones for the accommodation of arterial traffic.

"2. The improvement of city streets for the proper distribution of traffic and the servicing of adjacent property.

"3. The solution of the terminal problem by provision of facilities for parking and for the loading and unloading of goods.

"4. The improvement of the transit system, particularly in the larger cities.

"5. The improved operation of existing facilities."

(Annual Report, Bureau of Public Roads, 1947, p. 9.)

"Proper integration of expressways with terminal facilities is essential to

a complete transportation plan, which in turn is an essential element in the over-all city plan. Again, the need for effective cooperation between engineer and planner is emphasized." Traffic Engineering Functions and Administration, pub. by Public Adm. Service (1948), Chicago, p. 97.

"Control of access to the interstate routes, particularly in and near cities, is considered essential. Large streams of traffic cannot move swiftly and safely if obstructed continually by vehicles entering and leaving an express route. Access points should be provided wherever they are needed, but access at every crossroad, street, business place and residence would nullify the primary purpose of an expressway." (Annual Report, Bureau of Public Roads, 1947, p. 7.)

"Where there is no control of access, and roadside businesses develop along the highway, interference between through-traffic and the roadside becomes of major importance, reducing the capacity of the highway and increasing accident frequency. As traffic increases, the roadside businesses become more profitable and increase in number, still further increasing interference, lowering capacity, and increasing hazard. Congestion develops, and attempts to correct the deficiency by widening are prevented by the high value of the very businesses which produced the obstructions. Obsolescence grows and authorities are ultimately forced to relocate the highway. This is a wasteful procedure which may be avoided by control of access from the beginning." (Annual Report, Bureau of Public Roads, 1951, p. 7.)

(9) "The commercial area of the United States was probably more than doubled by the development of a vehicle that using the public highway could serve as a practical form of transportation under unlimited variations in the volume and kinds of traffic. . . . Previously the area which might be considered the commercial United States consisted largely of limited strips of territory ten to twenty miles wide adjacent to railroad lines, navigable waterways and areas around cities and towns, leaving extensive interstitial areas without access to market centers." "Economics of Transportation," by M. L. Fair and E. W. Williams, 1950, pp. 76–77.

(10) "Has An Abutting Owner Any Vested Right With Respect to Access to a Highway Not Constructed But Which is to Be Constructed on Property Which Is Being Acquired?" by C. W. Phillips, assisted by J. B. Hutton Jr., Sub-Committee on Legal Affairs, American Association of State Highway Officials, December 4, 1950; "Restricted Dedication of Rights of Way for New Expressways, Or Other Limited Access Facilities," by J. B. Hutton Jr., Highway Research Board Bulletin No. 38, 1951, p. 38 ff.

(11) In May 1952 Mr. Owen Clarke wrote in a law review as follows: "If the State purchases a new right of way running through a man's property it pays for the land taken and 'severance' damages for the separation of the property. But it should not compensate the owner for the loss of a right of access which he never had. Similarly, if you sell to the public, for a freeway, a strip of land extending along the boundary of your land, your next door neighbor should

not be entitled to compensation. He has never had a right of access across your property line before. In such cases the abutting property owner suffers only the loss of an unearned increment of land value. The restriction to access merely takes away the value which the construction of the road created. Although it seems academic that a property owner should not be compensated for the loss of such an unearned, speculative profit, some courts consider it as an element of damage. Most jurisdictions, however, adhere to the principle that there can be no detriment to a right which never existed and no compensation for a loss not sustained." The case of *City of Los Angeles* v. *Geiger*, 94 Cal. App. 2d 180, was cited. "The Limited-Access Highway," by Owen Clarke, "Washington Law Review and State Bar Journal," Vol. 27, No. 2, p. 111, p. 122, May 1952.

(12) *Clark* v. *Poor* (1927) 274 U.S. 554; *Story* v. *New York* (1882) 90 N.Y. 112; *Cannon* v. *Villars* (1878) per Jessel, M.R., 8 C.D. at p. 421.

(13) Tiffany, "Real Property," Sec. 1111, 3rd ed.; *Home Laundry Co.* v. *City of Louisville* (1916) Ct. App. Ky., 182 S.W. 645 (pedestrian street); *Tyler* v. *Sturdy* (1871) Sup. Jud. Ct. Mass., 108 Mass. 196 (footpath).

(14) *Stafford* v. *Coyney* (1827) 7 B. & C. 257, 108 Eng. Rep. 719; *Lock* v. *Abercester Ltd.* (1939) Chan. Div. Ct. App., Eng., Ch. 861 (A carriageway may be used by motor cars. "The law must keep pace with the times."); *Ballard* v. *Dyson* (1808) 1 Taunt. 279, 127 Eng. Rep. 841 (A private way).

(15) *Brocklebank* v. *Thompson* (1903) Chan. Div., Ct. of Appeal, Eng., 2 Ch. 344 (A churchway, established by immemorial custom).

(16) *Winch* v. *Conservators of the Thames* (1872) L.R., 7 C.P. 458, 471 (Towpath, established by custom).

(17) Special Roads Act of 1949, 12 & 13 Geo. 6, C. 32. See Note 10, for list of states.

(18) "The Modern Law of Real Property," by G. C. Chesire, 6th ed., 1949, p. 216, 230, 275; Tiffany, "Real Property," 3rd ed. Secs. 772, 923.

(19) *Lynchburg T. & L. Co.* v. *Lynchburg* (1925) Sup. Ct. App. Va., 128 S.E. 606, 43 A.L.R. 752; 131 A.L.R. 1472; 58 A.L.R. 854; *Woodyer* v. *Hadden* (1813) Ct. Common Pleas, 5 Taunt. 125, 128 Eng. Rep. 634; *Poole* v. *Huskinson* (1843) Exch. of Pleas, 11 M. & W., 827, 152 Eng. Rep. 1039; *Ballard* v. *Dyson* (1808) 1 Taunt, 279, 127 Eng. Rep. 841; *Greenwich Bd. of Works* v. *Maudsley* (1870) L.R., 5 Q.B. 397, 404 (Footpath on a sea wall established by usage, and not inconsistent with use of land for seawall): Nichols, "Eminent Domain," 3rd ed., by Sackman and Van Brunt, Secs. 9.2 (2), 9.36, 10.21 (2).

(20) Nichols, "Eminent Domain," 3rd ed., Sec. 5.72 (1).

(21) See Note 19; *Cannon* v. *Villars* (1878) 8 C.D. at 421, per Jessel, M. R.; Holdsworth, "Hist. Eng. Law," VII, 337.

(22) See note 12.

(23) "This conveyance is made for the purpose of a freeway and the grantor hereby releases and relinquishes to the grantee any and all abutter's

rights of access appurtenant to grantor's remaining property, in and to said freeway." "Right of Way Manual," California Department of Public Works, Division of Highways, "Freeway Deed Clauses," Section 8.20, p. 247. If access rights to only a portion of the expressway are to be acquired, the deed should so stipulate, and the grantor should reserve the right of access to specified parts of the expressway. Ib., p. 247. Where a service or frontage road connecting the abutting property with the freeway is planned, the following clause is used: "This conveyance is made for the purposes of a freeway and adjacent frontage road and the grantor hereby releases and relinquishes to the grantee any and all other abutter's rights including rights appurtenant to grantor's remaining property, provided, however, that such remaining property shall abut upon and have access to said frontage road which will be connected to the freeway only at such points as may be established by public authority." Ib., p. 251. A clause is also used which acquires any and all appurtenant rights, such as view, light, and air, together with the access rights of owners of abutting land. Ib., pp. 245, 250.

(24) An act of the State of Oregon, May 12, 1951, Chapter 587, Section 1, provides "No rights in or to any state highway, including what is known as right of access, shall accrue to any real property abutting upon any portion of any state highway hereafter constructed, relocated or reconstructed upon rights of way, no part of the width of which has heretofore been acquired for public use as a highway, by reason of the real property abutting upon the state highway." Cf. *Walker* v. *Mackey* (1953) Sup. Ct. Oregon, 253 P. 2d 280, 285 (construing Section 14, Ch. 226, Oregon Laws 1947, giving a right to a service road where an expressway destroys all access lands to farmlands).

(25) *Kane* v. *New York Elevated Railway Co.* (1891) N. Y. Ct. App., 125 N.Y. 164, 26 N.E. 278, 11 L.R.A. 640.

Traffic Engineering Problems In Cities Under 50,000 Population

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TRAFFIC congestion and delay, long a problem in *large* municipalities, is today being experienced in small areas as well. Small commercial cities, the shopping centers serving half of our population, are suffering an arterial constriction which, when proportionately applied, make big cities' problems pale. The significant lack of correlation between town population and traffic problems becomes apparent when vehicles equal to one and one-half, and even two times, the town's human population pass points on different streets in a day's time.

Close observation, with some theorizing, produces plausible explanations. The most significant factor is population dispersion. The population of a *town* is a poor indication of *regional* population. A drive through the surrounding territory reveals homes on every country lane. Electricity and modern methods of individual sewage disposal and water pumping have given rural areas a new way of life—city living on a country lane.

Suburbanites plus farmers and the farmer-factory workers[1] produce a large area population in no way accounted for in town statistics. Incorporated population figures are insignificant. A large regional population is in itself of little traffic significance until coupled with vehicle ownership and use. A dispersed population by its nature *produces* vehicle ownership and use.

1 The farmer-factory worker is not a southern original, but he has certainly found himself adaptable to this part of the nation. His stay in the country is economic: he is by trade a cotton or hosiery mill worker, and by classification, a farmer. When the mills are operating, he works there; when they are not, he farms—recently an advantageous economic position.

First, let us examine the small city alone. There are no residential parking problems, no large apartments, few resident hotels. Each home has its garage and driveway, and parking on the street is generally allowed. Usually, there is limited public transportation, if any. Recreation and entertainment are dispersed; they encourage the use of automobile-drive-in theaters, nearby lakes, mountains, seashore, rural parks. Even the picture theaters, no longer bound to a central location, all beckon the populace. Combine all of these foregoing factors with a high family income and relatively low cost of living, and the results are high vehicle ownership and use. The family income is more than sufficient because of joint contribution by several members; living costs are lower because of low rent, land and building costs, and lower food costs where local farm products are used.

The vehicle, its ownership and use, come first before food, family, and home in consuming the family income. This situation might be called "auto-mania." Although a new, medium-priced car in front of an unpainted shack might be a good example of this fixation, it is not exclusively of the lower economic group.

The situation in rural areas is an accentuated reiteration of small-city conditions. In rural areas, shopping facilities and recreation are even more dispersed, and the distance to them greater. With extremely limited public transportation, a vehicle is a near necessity, especially where the need for transportation to and from work in the city is concerned. This "almost necessary" need is combined with the ability to "buy and use." The ability to buy and use is again a product of high family income and low cost of living. No group has experienced as great an income increase, with retention of reasonable living costs, as the rural people. Their ability to produce a portion of the food they eat, plus lower land values, plus a good market for their products and readily available jobs in industry, have put them in a most favorable economic position. All of these and "automania" give us ever-increasing traffic from the country.

The congregation of these suburban factions within the limited bounds of the small city produce traffic problems as critical, on a comparative scale, as those of any large metropolitan area. This

is especially true on weekends when everyone comes to town. In by-gone days when the weekend was Saturday afternoon, and everyone kept the Sabbath holy, the *weekend* was not significant; but today it is rapidly becoming a full three-sevenths of the week in time and three-fifths in traffic. The day of more play than work is not being confined to any one segment of our society. The farmer, the office worker and the factory workers are reaping the benefits of greater mechanized production in free time and spending money. A four-day week is approaching; in small city traffic, it is already beginning to show. In fact, it is today much more logical to design for the weekend than for the other four days in the week; there are several bases for this statement:

The major portion of the area population is affected at this time. The majority of the week's traffic is encountered during the three days, Friday, Saturday and Sunday. Downtown merchants' interests are best served by designing for their busiest days. The design will generally apply during the other four days, especially during peak periods.

Present Engineering Service for Towns

Having diagnosed the ill, the next logical step is to prescribe the remedy. There are two major types of remedies for small cities' traffic ills: *The one-survey traffic report* and the *single location traffic study*. Of the two, the one-survey report is by far the more desirable. The usual procedure is for a consulting firm to make an overall study of the traffic situation and render a report with recommendation for overall improvement. It has the advantage of being fairly inexpensive and extensive, and, if properly applied, will aid in solving the immediate traffic problem or the problem the surveyor encounters.

The clue to its great disadvantage is that it covers one instant. It is dated and usually by the time it can be effected, has become partly antiquated. Upon being effected, it appears even more antiquated since it will invariably shift traffic and produce new problems at other points. Improvements that can be made in this method would greatly increase its value to small cities. One of the simplest

would be to date the survey as applying to the town for a three year period only. This would not only be much fairer to the town, but might possibly help the survey business. Another would be to schedule follow-up work as part of the survey. In this manner, necessary adjustments and additional corrections could be made.

The single location traffic study is the type of service rendered by some state highway departments. It is an attempt at solving small city problems by curing the ills of individual intersections. It usually takes place, one intersection at a time, as pleas come in from the towns. It can improve conditions at an isolated intersection, but its misuse in built-up areas and business areas nearly outweighs its advantage. It might find better application if applied after an overall count and a physical inventory of the area has been made; otherwise, there is danger of multiplying the problem at several intersections in exchange for a possible solution at one.

A Jointly-Supported Engineering Service

Of the remedies that can be offered to the small city, none holds more hope for long-range coordinated improvement than the jointly-supported regular service. By this method a group of towns employ an engineer, or an engineer and his staff, who render on a scheduled basis a continuing service. Individually the towns could not afford an engineer; jointly they can offer a salary high enough to attract training and experience at a cost to each that will compare favorably with the cost of individual surveys and the recurring visits of consultants (when the relative effectiveness of methods is considered.)

Organization and Operation of Joint Service

This service is easy to describe and laud but difficult to bring about. Towns do not normally join for a common cause. Even though the service could originate through towns' joint efforts, enough rivalry and jealousy exist between neighboring cities to prevent the joining. Its inauguration therefore becomes a selling job.

In originating a service of this type, one of the first things for the engineer to do is to ask himself: "What can I offer?" Will it be

straight traffic engineering, traffic engineering and traffic planning, or traffic engineering and city planning? This will depend, of course, on his training and experience or the combined training and experience of associates. This may sound simple, but the product must be established and defined. The engineer must have a complete knowledge of the offered service readily available if it is to sell.

The second step is to select the geographical area. In this, town groups are of the foremost importance. A suggested minimum group is four or five towns within a thirty-mile radius, of which two or three have a population of more than 15,000 and all a population over 5,000. This minimum is for purposes of selection and future protection.

Next, and on nearly equal footing with grouping is a history of the people. Ascertain what kind of people are in the selected area or areas. A knowledge of the people with whom one must deal is of prime importance. Economic level, attitude, and politics are all important parts of their history. Again of nearly equal importance is a history of interest in traffic engineering and city planning. This will initially be somewhat sketchy, unless one writes the state League of Municipalities, tells them of his intentions, and asks for the information.

After selection of an area and initial town grouping, the next step is a personal inspection tour. Here the first items are general appearance and a check on the most apparent problems. Observe the street pattern, the condition of pavement markings and signs, traffic congestion and delay, the type of signal equipment in use, the cleanliness of streets and sidewalks, and other related points.

Next, check back issues of the local paper—read editorials, past election news, and the front page. From this there will be revealed the newspaper's attitude towards city operation and city officials, the political situation, a partial check on past studies, and some ideas of relations among cities.

For a first-hand exploration of the city, nothing can surpass conversation with local inhabitants. From them you can find out about the town in general, the traffic situation, what has been done, and their feelings towards the other towns. In a town with considerable traffic engineering activity, a city office clerk or minor official should

be visited. He will volunteer more information and material than a department head without breaking through the secrecy of this initial contact with the city. Secrecy is necessary for a proper evaluation of each town and the service offered before presenting it to the towns in which it has the greatest chance to succeed.

With a working knowledge of the situation in each town, the engineer must now weigh various assets and list the cities in order of desirability. A cost-and-time distribution can then be worked out for the first two, three, or four cities, the number to be served. The cost will depend upon the size of the town, the extent of the service offered, and engineering training and experience. A minimum of $6,000 and a maximum of $12,000 is suggested for one individual. Divide the cost and time among the cities selected according to their population. This is an initial division—there may have to be adjustments later.

The service is now ready to sell. For the average engineer this is the most difficult part of the whole process. The best method for accomplishing this would be a selling agency; in fact, there is a need for an organizing and selling agency to handle the entire process involved in starting a joint service.

For the engineer of average sales ability, probably the best initial contact is a well-composed letter. It should be fairly brief and at the same time inclusive. Make a brief introductory statement of "purpose" and give some personal background information. Describe the details of the service offered and in doing so *sell it*. Describe the inspection trip; of course, it is not advisable to call it that. Make the most of any efforts to solve the cities' problems. Be sure to compliment them.

Towns that have done most, and are most advanced in their engineering efforts, will show the greatest interest.

Last, describe the initial time-and-cost distribution.

There are arguments both for and against a one-shot letter of this type. It does not allow for a proper build-up or introduction; but for getting decisive positive and negative results it is superb. It is an excellent red-tape cutter and saves both time and money. Do not present this letter as an engineering report, nor as a friendly letter. Make it your representative.

When the initial letter is favorably received, there will be additional correspondence, personal visits, and a good deal of tailoring of the service to fit the towns. Tailor freely but with discretion, for it is possible to destroy its value through improper time-and-cost distribution.

Once the actual participants have been decided, each community will have to be organized. There are three types of organization; it might be wise to try a different one in each city and later adopt in all towns the one that works best.

The types of organization are: Separate department; pseudo-departmental status, and engineer-advisor.

A separate department is best from the control standpoint. A pseudo-departmental status is best from the budget standpoint and it still retains adequate control. In the pseudo-arrangement, personnel and equipment are paid for through other departments. This is an advantage in a small city operation because much more operating capital will be available when expenditures are attributed to and distributed among other departments.

The third type, engineer-advisor, is exactly as stated. Advice is given and recommendations are made to be carried out by others. This gives the greatest freedom of action and best results.

In most of today's towns, the engineer will either inherit or have a part in the formation of a commission or board to assist in the conduct of traffic or planning operations. It may be a traffic commission, a planning board or a combination board. It is most important to work closely with them, to let them know what is going on, and to teach them. On occasion, their functioning time will cause delay, but the advantages gained from working with some of the leading people in the community far outweigh any disadvantages.

An Example of the Operation of a Joint Service

This example is presented to stress not only the scope of the work in a small town, but also the lack of a minimum population limitation. The town whose operation is described herein is a highly industrialized city with twenty-two plants with an average of 150 employees each. The plants manufacture gloves, cotton goods, hosiery,

furniture, vehicle bodies and other products. It is situated at the center of a farming county, and is its farm center and county seat. The county has a population of 65,000+ of which 20,000+ are drawn to the city for all or part of their buying and commercial needs.

The service rendered this city is a combination of traffic and planning on an engineer-adviser basis. Because of considerable interest on the part of city officials, this method has been reasonably successful in this town. As an indication of the success there follows a list of completed projects of the past year and planned projects for the coming year.

1—Completed Projects (past year)

a—Base Map of the town for traffic and planning purpose from controlled Aerial Maps.
b—Complete Traffic Survey
c—Traffic Volume Map
d—Truck Routing
e—Major Street Plan
f—Traffic Plan for Downtown Area
g—Intersection Studies and Channelization
h—New Traffic Ordinance
i—Subdivision Ordinance
j—Various other small projects, such as Intersection Signalization, Design of Four Municipal Parking Lots, etc.

2—Planned Projects (coming year)

a—New Parking Meter Ordinance
b—Industrial Survey (in progress)
c—Re-sign entire town
d—Speed Zoning
e—Revise Zoning Ordinance
f—R. O. W. Acquisition for three new thoroughfares in accordance with Major Street Plan
g—Re-time all signals in downtown area, install new equipment where required and make changes in downtown traffic plan
h—Plan widening of streets in downtown area
i—Install three traffic actuated signals

From the foregoing, it can be seen that a town of only 7,000 with a sufficient interest and a will to improve, can more than consume its share of an engineer's time in a joint arrangement.

Advantages and Disadvantages

For the cities and for the engineers, the joint service offers three distinct advantages:—it allows regular contact with the town's problems;—it provides "qualified" personal direction, and—it provides for the evolution of the city and its problems at a cost consistent with the quality of the service offered.

As in any type of arrangement, there are disadvantages. The major one in this case is a time-limitation. There are a limited number of possible working hours in a day and since any person can only be in one place at one time, considerable time difficulties can arise. Unless properly controlled through restraint in not only the amount of work in progress, but also in night meetings of planning boards, city councils, council committees, etc., the time distribution in this service can get completely out of hand. Once the basic time arrangement gets out of line, it is nearly impossible to correct it.

Another disadvantage is lack of available funds. In small cities the engineer's capability can far outstrip the town's ability to keep up. Recommendations have to be keyed to the town's ability to pay or the engineer's ingenuity in producing miracles with second-rate equipment.

A third disadvantage is organizational and it may or may not be present in cities. It depends upon the cities' ability to hire responsible intelligent personnel. It is impossible to be in each town all of the time. Someone must be available to carry out operations. If such a person is not available, there is a serious problem.

Closing Statement

The need for this service is as widespread as the cities it can serve. There are 2206 cities in the United States between 5,000 and 50,000 population. Of these, 252 are between 25,000 and 50,000 population, 778 between 10,000, and 25,000 and 1,176 between 5,000 and

10,000. If we assume that one traffic engineer can serve three cities in the 25,000 to 50,000 group, four cities in the 10,000 to 25,000 group, and six in the 5,000 to 10,000 group, we can arrive at a potential need for 474 traffic engineers.

If we assume that two-thirds of these are not available because of adverse conditions such as location, politics, lack of interest, etc., there are still 158 potential positions. Whether traffic engineer, or traffic and planning, the jointly-supported regular service for a town under 50,000 is the best for the money. It can accomplish more in traffic movement, safety, and planning, for present and future than can be accomplished by any other method.

All the plan needs to become one of the leading forms of traffic engineering in this country is an organizer and a salesman.

The Democratic Way

GEORGE GOODWIN

Mr. Goodwin has been Executive Director of the Central Atlanta Improvement Association since July, 1952, and is currently executive secretary of the Georgia State Senate Transit Study Committee. From 1939 until 1952, Mr. Goodwin was a reporter for various newspapers, including the Washington (D.C.) Times-Herald, the Miami (Fla.) Daily News, and the Atlanta (Ga.) Journal, with the exception of the three years he served in the United States Navy in World War II. He won a Pulitzer Prize and National Sigma Delta Chi Award for stories on the Telfair County vote fraud in 1948, and the Pall Mall "Big Story" award in 1950 for coverage of the Refoule murder case, Atlanta. He was awarded a travel fellowship to Israel and the Middle East by the American Christian Palestine Committee, 1951. As executive director of the Central Atlanta Improvement Association, Mr. Goodwin heads a large group of downtown Atlanta property owners in their efforts to preserve and enhance downtown property values. His work includes seeking relief for traffic, parking, transit, planning, slum clearance and other problems affecting downtown Atlanta.

AFTER five years of record-breaking post-war automobile production and urban residential expansion, traffic in American cities has passed beyond the problem stage. We have expressways and street widenings, channelization, complicated traffic signals and laws to reduce speed. We have laws to *increase* speed and scores of other "solutions." In spite of all this, things are worse instead of better. The *problem* five years ago is today's *emergency*.

Baffled by nothing more complicated than a simple American desire to drive one's own automobile downtown to work or shop, many traffic engineers, public officials and others are about ready to throw up their hands and declare that only a ruthless dictator can meet the emergency.

There is a great temptation to agree with this school of thought. Despite gigantic evils, dictatorship often has the merit of efficiency. Even in America we have turned in times of crisis to semi-dictator solutions. Examples include extraordinary presidential powers in times of war and peacetime, martial law in disaster areas.

Although the harassed traffic planner may sigh for dictatorship, he knows that in America the people generally will not accept this answer. There must be another way.

Thus we have a basic question facing every American city—how can a democratic process produce the efficient solution that might be anticipated from a traffic dictatorship? The answer undoubtedly is the same as democracy's successful answers to dictatorship have always been—in combining a lot of good sense and some self-denial to make democracy work. Where dictatorship reaches its efficient ends through planning and a firing squad, democracy traditionally has won out by combining planning, economic law, competition, cooperation and education.

Three Traffic Trends Analyzed

At least one city – Atlanta, Georgia (metropolitan population 600,000) – is proceeding on this philosophy. The approach in Atlanta is too new for critical appraisal as to results, but the process now under way there is worthy of careful examination.

A lion's share of the credit in Atlanta must go to their Metropolitan Planning Commission, a public agency jointly financed by the City of Atlanta and the counties of Fulton and DeKalb. Additional credit goes to the Atlanta Traffic and Safety Council, the Chamber of Commerce, the Central Atlanta Improvement Association, and to local, state and federal governments.

A first step in the democratic process is the analysis of major trends at work. At least two apply to all cities and a third has special application in the South and the far West.

The first nationwide trend is urbanization. The 1950 census shows that throughout America the population is moving from farms to cities—not just to the big cities, but to all cities of 25,000 or more. The implications of this movement are obvious. The cities are already in existence. In most of them downtown areas are pretty well established. Office buildings and other major structures must be accepted as permanent. Street widths are fixed, and in most cities little can be done about them without terrific cost.

Most of these cities were laid out, and street widths were deter-

mined, in days when the population moved primarily on foot or in carriages. This great mass of people moving into our cities today, however, is not walking in. They are coming in their automobiles. Thus for the first time a majority of Americans now live in urban areas, and a majority have automobiles. Urbanization is the first great trend.

The second great trend is a movement within the cities themselves. It is a movement by people, by enterprise, and by money from the center of cities to their outskirts. Again the automobile is the thing that makes the movement possible; it stimulates it every time a car is sold.

Atlantians found that most conservative estimates—not only by planners but also by cold, calculating businessmen, indicated that the area population would increase from its present 600,000 to 1,000,000 people by 1970, or at the latest by 1975. The most serious implication was that, statistically speaking, not one of those additional people would live within the thirty-five square miles that were the city limits of Atlanta in 1951 (official limits were expanded to 125 square miles in 1952 and 1953). In short, Atlanta had to anticipate four new cities of approximately 100,000 population each, about equally distributed in her quadrants of growth.

The third great trend recognized by economists throughout the nation is the economic development of the southeast. That means that Atlanta and other major southern cities must expect expansions of regional functions along with their increased populations.

All these trends put particularly great responsibility on the downtown districts, which invariably provide the greatest single source of income. Downtown ad valorem taxes alone usually produce from 25 to 50 percent of any city's property tax revenue. Collapse of downtown areas and downtown values, already noticeable in several American cities, invariably has meant a drop in city revenue.

Unplanned Decentralization an Enemy

Atlantians determined that decentralization per se is not evil; indeed, for a city like Atlanta which has no natural barriers and can

expand to all points of the compass, certain types of decentralization are healthy. Decentralization as an idea is not the enemy, but unwise decentralization, unplanned decentralization is the enemy. For example, a downtown district does not suffer when all the grocery stores there move to the suburbs. Outward movement of industry, warehousing, and other functions which require a great deal of space but use relatively few people is healthy; but a downtown district would be destroyed if all office-building-occupants moved away.

Thus part of the problem in Atlanta, and elsewhere, is to prevent unwise decentralization at a time when wise decentralization is the order of the day. Atlanta has determined that she has two tools to help her in that dilemma. One is planning. The other is access—communication—guaranteeing the easy movement of people to and from the center of the city in all directions.

Keeping in mind that solution requires dictator ends without dictator means, let us look at the first one—planning. In honesty it must be said that planning—and its subordinate partner, zoning—represent to a degree a limitation on the basic democratic idea that an individual has the right to use his property and his automobile in any way he pleases. For this reason some people reject planning as socialistic. They would be wise to recall that planning is based on another good American idea—that of the greatest good for the greatest number.

Because of this conflict, it is vitally important that planning itself be a democratic process, with ideas and patterns being determined from the bottom up rather than imposed from the top down. This primary rule governs all action of Atlanta's Metropolitan Planning Commission. It provides an avenue through which all interested persons and agencies can—indeed they must—participate in planning the traffic solution.

In Atlanta this has required a lot of conferences and meetings involving busy people, but it seems to guarantee that solutions reached through this procedure are promptly accepted by the primary interests of the community and are easily sold to the average citizen. Atlantians are not seeking a tight master plan. Rather, they seek a flexible one; and their emphasis always is on planning as a process rather than on minutely detailed blue prints.

With the trends examined and the great question of traffic somewhat in focus, Atlanta set out to approach the problem through its several facets. Currently this city probably has more individual studies now being applied to traffic than any other city in the country.

Atlanta Applies Traffic Studies

A citizens' commission administers the expenditure of nearly $30,000,000 of local expressway bond funds, matched by a like amount of state and federal funds during past and future years. Last March, another citizens' committee was created by the Georgia General Assembly to make a detailed study of transit problems and to determine how transit can be fitted into an overall transportation plan. Still another commission created by the General Assembly is studying parking. It is making an inventory of existing facilities, projecting off-street needs and devising a community approach to meet them. The Traffic and Safety Council brought in the Northwestern Traffic Institute for a study of the police department and its enforcement methods.

This same group, assisted by the American Bar Association and the Atlanta Lawyers' Club, is working with still a third legislature-appointed citizens' committee to determine the best traffic court procedure. The Municipal Planning Board, which concerns itself primarily with zoning, has employed a consulting firm to prepare during this year a comprehensive zoning law for Atlanta and Fulton County, while the Metropolitan Planning Commission is preparing a similar law for adjacent DeKalb County.

The Municipal Planning Board, the city traffic engineer, and the Traffic and Safety Council are preparing a major street plan to complement the expressway system. Also a group combining officials and private citizens under the name of the Atlanta Traffic Commission, makes recommendations on parking meter locations, parking bans, transit stops and other minor traffic matters.

Obviously, there was a danger that these various forces might pull apart in their individual traffic approaches instead of moving toward a common center. This has been avoided by development of a master group, including representatives (the administrator or

executive and one policymaker) of all these groups, plus representatives of the city council's police committee, the Georgia State Highway Department and the U. S. Bureau of Roads.

This full committee meets monthly, but its working force is a technical committee comprising the executives and administrators of component organizations. They meet at least every two weeks. In sessions of the technical committee—sometimes heated sessions—information is pooled, progress is reported and points of view are either coordinated or distinctly defined for policy decisions by the full group.

Staff members of the Georgia Technological Institute's graduate school of city planning serve as consultants to the Transportation Planning Council, and the staff of the Automotive Safety Foundation is likewise available for consultant services. Outside consultants employed by the Transit Study Committee or by the Parking Commission sit in on meetings of the coordinating committee. The primary objective of the Transportation Planning Council is to weld these various approaches into a flexible but coordinated transportation plan for Atlanta.

Planning for Access

This means determining how to use the second tool in the democratic approach to a traffic solution—access. Basic directions for the use of this tool are or should be applicable equally in Atlanta or in any other major city.

Access, incidentally, is the expensive tool. The cost of planning a building is relatively small in comparison with the cost of constructing it, yet the blue prints are worthless unless the building is built, even as construction is impossible without the blue print.

In simplest terms, access means the easy movement of people and goods—not vehicles, not automobiles, not trucks, not trolleys, not buses, not taxis—but *people*. The only reason for the existence of a downtown section, or for a city itself, is to serve people. And it must have people to exist.

As yet no one has come up with an absolute solution—within a democratic framework—to this problem of the movement of people.

There is no magic prescription that can be taken by a community, either in small doses or in one great gulp, to produce permanent relief. People and the problems they create when they come together cannot be handled so easily. There is no perfect prescription, no magic formula. There is however at least an area in which a democratic solution may be found. It lies not in serving the vehicle but rather in serving the man who drives it or rides in it. We can accept as a truism that vehicles are less important than people.

This statement, incidentally, is easily overlooked when one gazes out of an office building window and sees below a street jam-packed with automobiles, trucks and transit vehicles. It is dangerously easy to see the machines and to forget they are merely instruments of the human beings inside them.

Cities today are concerned primarily with the *movement* of people—the problem of retaining downtown access. This problem has three major phases that must never be separated: first, streets and expressways; second, parking; and third, mass transportation. They are of equal importance. If apparent solution of any one of the three phases of the access problem gets too far behind—or too far ahead—the entire problem is thrown out of balance, and solution may become impossible.

This seems to be happening in many cities. It was happening in Atlanta, with the expressway program far ahead of major street development, parking facilities, or mass transportation improvements. Completed portions of the expressway tremendously increased competitive advantage of private automobiles over transit vehicles, with the result that a flood of cars into the downtown area promptly produced a huge parking demand. Failure to supply it threatened to stimulate unwise decentralization.

There is a growing tendency on the part of all cities—and this includes the individuals both in private and public life who run our cities—to emphasize the automobile at the expense of the transit vehicle. For example: It was suggested in Columbus, Georgia, that transit vehicles be banned from the main street. Yet a simple calculation showed that a majority of people with a legitimate reason for being on the street used transit rather than automobiles. A little further calculation showed that perhaps twenty transit vehicles

operating on exact schedule could handle in that city as many people as 5,000 to 10,000 automobiles. It might make far more sense to consider banning a main street to motor vehicles and just turn the street over to pedestrians and a few transit vehicles.

Actually—until things get much worse—either solution is a bit fantastic. A wiser approach is to have those who spend Monday working for an expressway and Tuesday working for parking make sure they spend Wednesday serving the people who use mass transportation.

Most cities will find, as Atlanta is finding, that in continuing to provide on-street parking along major thoroughfares they are interfering with the rapid movement of automobiles and especially of transit vehicles with their large numbers of riders. This is a violation of what may be a basic axiom in the access idea, that existing streets and new streets and expressways must have the most efficient use possible.

For a city to provide free, or practically free, parking space on major streets at the same time it is spending millions of dollars to build new streets, is boondoggling of the rankest sort. It also violates a democratic principle that any product or service should be priced according to its true value. If downtown parking space in a garage or parking lot is worth fifty cents an hour, it is ridiculous for a city to sell the same product for five cents an hour especially when the city's great need is for street space rather than for revenue.

Natural functioning of economic laws is vital in a democracy. Many cities, to their own great disadvantage, unconsciously interfere with natural economic functions when they cling to the outmoded idea that any citizen has a right to park where he pleases and any merchant has a right to let his customers, his employees, or his delivery trucks park in front of his door. One part of any successful democratic approach to the traffic emergency requires that parking be defined, not as a right, but as a privilege to be extended only when a street is not needed for moving vehicles.

Not only can unwise parking prevent most efficient street use, but unwise design of new streets and expressways, or failure to tie them properly into the existing street pattern, can have the same effect. Many cities have plunged into the construction of expressways

and other major traffic facilities with little or no consideration for streets that must take traffic to and from them. There has always been widespread tendency to design and build expressways without adequate thought on how such facilities can be made to serve the maximum number of people, not vehicles.

An expressway used by both private motor vehicles and transit buses can carry during a rush hour far more people than the same facility used by private vehicles alone. Such dual use enables transit to compete timewise with the private automobile. This is imperative if the nation-wide trend from transit to private vehicles is to be stopped. A modern bus traveling swiftly over an expressway can transport downtown fifty persons. If those same persons are forced to use automobiles in order to enjoy the high-speed facility, they will, at the current ratio of 1.7 persons per car, add thirty automobiles to the rush hour traffic load and to the downtown parking demand. One hundred buses carrying 5,000 people can eliminate 3,000 automobiles, and this is equivalent to the *total rush hour carrying capacity of two modern expressway lanes.*

Atlanta Studies Transit Service

Atlanta very nearly stumbled into this error. As in every other city, transit in Atlanta has been losing riders steadily. This loss resulted in reduced service and increased fares. These in turn produced further reduction in riders. During the period when that descending spiral was having its worst effect, Atlanta was planning an expressway system. Part of the system was almost completed before any local official suggested that this magnificent new facility might be far more efficient if it were used to carry express transit vehicles as well as automobiles.

Such use had not been considered in the design of the facility. Even the transit company itself had failed to point out that here was a means of providing rapid transit service without the overhead of maintaining rails or a private right-of-way. It was not until the Atlanta Transportation Council began to function that anyone suggested that transit riders should have the benefit of expressway travel. Since the expressway had been financed primarily from public bond

funds, transit riders through payment of ad valorem taxes had already paid for the privilege.

Failure to realize that transit offers a highly efficient means of moving people over an expressway and thereby postpones the time when the new facilities will be saturated with motor vehicles, is a typical example of planning for vehicles rather than for people. Too often planners, engineers, public officials and others look at a transit vehicle and see in it simply a public utility company busy making money. What they should see is not a bus or even a company, but people—human beings, taxpayers, voters—who happen to use that means of conveyance rather than automobiles.

In the longest run, it is relatively unimportant whether the transit operation is a company making money, or a company losing money. The most important factors are the fellow inside the bus and the businessman, sales person, or job waiting for him at his destination. Unless transit is accorded a status of public concern equal to that of streets and parking, no city can approach the matter of access as the three-headed proposition it is.

Transit may prove to be one of the most difficult elements to fit into the democratic process. This difficulty arises primarily from the fact that in many cities elected officials and regulating agencies have not updated their thinking since the pre-automobile days of the "traction magnates" when street cars were the primary means of moving people, and their noncompetitive operation was tremendously profitable. Nevertheless, because of transit's tremendous carrying capacity, it is bound to be a vital factor, perhaps *the* vital factor in any solution.

Retail interests, trucking interests, downtown property owners, automobile dealers, parking operators and many other groups, all must play thoughtful, cooperative roles if cities are to have any hope of meeting the traffic emergency.

Any democratic solution is bound to require a great deal of patience, wise use of existing and potential laws, and a lot of money. The dollar cost, although high, can be reduced by any city that makes full use of all of the tools at hand. Again the democratic process requires wide citizen-participation in determining the amount of dollars—both present and future—that the city can spend in its

continuing war on traffic. The potential cost, even after the most careful democratic planning, may be a staggering sum. Regardless of the amount, it will be far less than the cost in dollars, both to the city and to its citizens, of doing nothing or of doing only a fraction of the total job.

Atlanta, with her multi-facet approach to the transportation emergency, may or may not have the American answer. It is too early to tell. But her approach has certain important aspects to commend it to other cities for continuing examination. Her plan is broad; her analysis has the problem in focus; she has the access tool in hand, and has read carefully the book of instructions as to its use. Most important of all, she has a democratic approach in her search for totalitarian traffic efficiency.

If she maintains her present wise course, she has a good chance to point the way for herself and other cities to meet the traffic emergency. Or—equally important—she may show that there is no democratic answer.

Median Dividers on Urban Streets

JOHN T. HANNA

Mr. Hanna is City Traffic Engineer of Richmond, Virginia. Previously he worked in the Traffic and Planning division of the Virginia Department of Highways. He completed the Richmond Police Commissioned Officers' Training Course, and holds a certificate from the Yale Bureau of Highway Traffic. Mr. Hanna is also a graduate of the Federal Civil Defense Staff College and as Transportation Director of the Richmond Civil Defense Organization, he witnessed the atomic bomb detonation in Las Vegas, Nevada in March, 1953. He is a junior member of the Institute of Traffic Engineers and on the Board of Control of the Richmond Safety Council.

IN FEBRUARY, 1952, citizens and officials of Richmond, Virginia were confronted with several important problems—problems that necessitated decisions based on deliberate thinking. Before those decisions could be reached, many factors had to be weighed technically, practically and aesthetically.

Funds had been appropriated for major improvements on Broad Street, the city's principal thoroughfare extending for 6.2 miles eastwardly and westwardly through an area which included the central business district. Curb to curb width varied from eighty-three to eighty-six feet. Proposed improvements included smooth paving, reconstruction, removal of street center trolley wire poles, installation of mercury vapor lights, and new traffic signals. What was to be the new design of Broad Street? Should a median strip be installed? If so, what was its width and type to be? What are the advantages and disadvantages of various types of medians?

Each question had three answers—the practical, the technical and the aesthetic. Practically, what was the best for the least amount of money expended? Technically, what type of median would be the most efficient? Aesthetically, what kind of median is the most beautiful? To find the answers to these posers, a comprehensive survey of local median strips was initiated.

The major advantages of median strips were well known. These include:

1. Separation of opposing flows of traffic.

2. Prevention of midblock, U and left turns and reduction rear-end and turning collisions.

3. Provision for pedestrian refuge areas on wide thoroughfares.

4. Provision for shadow areas for left-turning and straight-through cross-street vehicles.

A local survey was made to determine other pertinent factors. Reference, Table I:

a. There are 29.4 miles of median strips in Richmond on major arterial thoroughfares.

b. The median strips consist of solid concrete, curbing and grass, and grass without curbing.

c. The median strips contain underground and overhead utilities, shrubs, trees, and wooden railings. These uprights are located at inconsistent distances from the edge of the curbing face or from the traveled portion of the roadway.

d. Each reported accident from January 1, 1947 to July 1, 1953, involving the median trip to any degree has been tabulated.

Numerous conferences were conducted with the city planner, the city arborist, and officials of the department of public works, department of public utilities and department of public safety concerning median strips. State Highway Department officials were consulted.

The basic types of existing median strips studied included.

a. Earth with curbing and grass.

b. Earth and grass without curbing, of both the raised and street level types.

c. Concrete using a light-colored type of cement for improved day and night visibility.

d. Sandbags of the canvas and burlap type. (These were used largely to determine ultimate design. No great barrier to traffic resulted. Damage was extensive, particularly to the burlap type.)

e. Cast-iron mushrooms, five inches high and 21 inches in diameter. These were used for short distances for special channelization needs.

f. Depressed. These were used generally for surface storm drainage where underground facilities were not available.

Table I

Types of Median Strips in Richmond, Virginia
July 1, 1953

Type	Width in Feet	Length in Miles	Traffic Volumes*	(Accidents 1-1-47 — 7-1-53) Number	Injuries	Fatalities	Property Damage	Remarks
Raised earth and grass—no curbing	15	1.00	Minor	—	—	—	—	Raised crosswalks rounded—granite ends Street name signs, light poles at intersection
Curbing and grass	14	.45	Minor	1	1	—	$ 100	Trees 9′ 7″ from curbing
Curbing and grass	44	1.80	Medium	16	9	4	6,472	Trees 3′ and 8 to 12″ from curbing Signals 16′ 7″ from curbing—monuments
Curbing and grass	36	.20	Minor	—	—	—	—	Trees 11″ from curbing
Concrete	4	1.40	Light	1	2	—	100	Light poles 1′ 5″ from curbing
Curbing and grass	11	.30	Light	—	—	—	—	—
Curbing and grass	9	1.25	Heavy	6	—	—	1,140	Trees 3′ 10″ from curbing Signals 4′ from curbing
Curbing and grass	10	.40	Minor	—	—	—	—	Trees in center
Curbing and grass	30	.15	Light	—	—	—	—	Scattered shrubs in center
Curbing and grass	10	.40	Minor	—	—	—	—	Trees and shrubs in center
No curbing—grass	40+	.20	Light	—	—	—	—	Trees 8′ 7″ from roadway edge
Curbing and grass	24	.20	Light	—	—	—	—	Shrubs in center
Concrete	6	1.30	Heavy	1	2	—	1,500	Signal poles 2′ 5″ from curbing
Curbing and grass	58	.20	Light	1	1	—	100	Shrubs 10′ from curbing
Curbing and grass	9	1.10	Light	—	—	—	—	Concrete poles 3′ 10″ from curbing Shrubs 4′ 2″ from curbing
Curbing and grass	14	.30	Minor	—	—	—	—	Shrubs 6′ 4″ from curbing
Curbing and grass	30	.40	Light	1	—	—	250	Trees 3′ 7″ from curbing
Curbing and grass No curbing and grass	16	4.10	Heavy	28	17	—	13,547	Wood poles and lights 2′ 9″ from roadway edge Ditch 4′ 7″ from roadway edge—also turning lanes
Curbing and grass	28	1.30	Light	—	—	—	—	Curves
No curbing and grass	16	1.10	Heavy	10	13	—	2,885	Trees 1′ 4″ from roadway
Curbing and grass	16	.20	Heavy	1	—	—	175	Shrubs 8′ 7″ from curbing Trees 8′ 7″ from curbing
Curbing and grass	10	.40	Heavy	1	—	—	100	—
Curbing and grass	20	.40	Heavy	1	2	—	1,040	—

Curbing and grass	10	.40	Heavy	1	—	—	100	—
Curbing and grass	20	.40	Heavy	1	2	—	1,040	—
Curbing and grass	27	1.00	Heavy	5	1	—	1,785	Trees 2′ 10″ from curbing Trees 6′ 8″ from curbing Concrete poles 4′ 1″ from curbing
Curbing and grass	21	.60	Heavy	—	—	—	—	Trees 7′ 5″ from curbing Signs 9′ 11″ from curbing
Concrete	6	.20	Heavy	2	1	—	345	Concrete light poles 1′ 4″ from curbing
Curbing and grass	20	.60	Heavy	5	1	—	2,015	Street light poles 9′ 7″ from curbing
Curbing and grass on approaches	4	.20	Heavy	4	2	—	2,740	Ribbed curbing Ribbed strip over bridge
Curbing and grass	28	.65	Light	—	—	—	—	Trees 4′ 5″ from curbing
No curbing and grass	15	1.00	Light	2	—	—	675	Trees 4′ 4″ from roadway edge
No curbing and grass	25	.80	Light	—	—	—	—	Trees 2′ 8″ from roadway edge Wood rail 3′ 9″ from roadway edge
No curbing and grass	25	.60	Light	—	—	—	—	Trees 3′ from roadway edge Wood rail 3′ from roadway edge
No curbing and grass	25	.60	Light	—	—	—	—	Trees 1′ 8″ from roadway edge Wood rail 2′ 6″ from roadway edge
Curbing and grass	18	.60	Light	—	—	—	—	—
No curbing and grass	20	.40	Light	—	—	—	—	Trees 3′ 4″ from roadway edge Granite uprights at radii 2′ 8″ from intersection
No curbing and grass	20	.25	Heavy	2	2	—	520	Trees 6′ from roadway edge Light poles 6′ from roadway edge Barricade fence near driveways
Curbing and grass	47	.10	Medium	—	—	—	—	Trees 8′ 8″ from curbing Light poles 20′ 10″ from curbing
Curbing and grass	30	.95	Medium	3	2	—	2,000	Light poles 14′ 9″ from curbing Trees 9′ 4″ from curbing
No curbing and grass	24	2.75	Medium	10	8	—	3,255	Wooden poles 15′ 9″ from roadway edge Wooden poles 5′ 9″ from roadway edge
Cast iron mushrooms Dia. 20″, height 5″		.05	Heavy	—	—	—	—	—
TOTALS	—	29.40		101	64	4	$40,744	

* Volumes:

Heavy, over 20,000 vehicle daily average.
Medium, over 10,000 vehicle daily average.
Light, over 3,000 vehicle daily average.
Minor, under 3,000 vehicle daily average.

Design Features Studied

Curb heights varied from two to eight inches. Where the curbings were less than four inches high, extensive damage to the grass area resulted, due to vehicular encroachment. The six-inch curb was struck least and was most convenient for pedestrians. The eight-inch curbings sustained considerable damage from vehicle hub caps and fenders.

Where there was no curbing, damage to grass, trees and shrubs was frequent. Vehicles were operated over the median mostly in passing. At night, the edge of the roadway surface was not plainly visible. U-turning vehicles damaged the ends near intersections. Control of parking, especially near churches and shopping centers, was impractical. The desire to park at an angle was pronounced. Angle parking created congestion, confusion, and high accident rates.

With curbing, emergency parallel parking caused minimum difficulty and was easy to control. A city ordinance prohibits parking adjacent to median strips unless indicated by proper traffic signs.

Where U-turns across sidewalks create a serious problem, the extension of the median to the inside of the crosswalk has minimized difficulties. Raised medians require the pedestrian to step up. Where there is danger of pedestrians' stumbling into fast-moving traffic or where numbers of wheel-chairs and baby carriages cross the intersection, a raised section across the median is not advisable.

The minimum opening at intersections should be fifty feet for easy turning movement. This is especially true where one-way streets with heavy left-turns intersect the median. Here, an extension across the crosswalk causes more congestion than benefit to pedestrians, unless the pedestrian accumulation is high.

Raised buttons just inside the crosswalk line nearest the center of the intersection are constantly struck and cause considerable objection from motorists.

Concrete median strips varied from four to six feet in width. All others varied from nine to fifty-eight feet. The minimum deemed practical for left-turning lanes and the protection of cross-street vehicles was found to be twenty feet. Officials of the department of

public works recommended that widths be in multiples of twelve feet to provide additional street width if needed.

Wide median strips in residential areas induced playing thereon by large numbers of children. Pedestrians were observed walking on the six-foot concrete median strip, from intersection to intersection, in the business district.

Surface Conditions on Median Strips

Median strips provide ideal areas for upright utilities such as electric poles, fire plugs, fire alarm boxes, traffic signal poles, street name signs, and other traffic route markers, regulatory and warning signs. Signs, signals, fire alarm boxes and fire plugs are plainly visible to both the side and main street traffic. On main thoroughfares, the single sidewalk traffic signs are not sufficiently visible to provide proper observation.

"Stop" and "Yield-Right-of-Way" dual sign indications on both the median and sidewalk increase effective traffic control. Accident rates are considerably lower at these locations.

Trees should not be planted in medians of less than ten-foot width. Carbon monoxide, lack of water, and heat retard proper growth. On all medians, trees should be located more than five feet from the curbing face. If less than twenty-four inches from the edge of the roadway, the roots have a tendency to cause surface buckling. Scuff and damage marks were pronounced on medians without curbing, and where trees were located less than three feet from the roadway edge. Where electric poles are located in the center of the median, trees should not be planted because of overhead interference.

Experts stated that trees should not be planted in medians unless public pressure forces this move. Trees are hard to maintain and the pace of street widenings usually exceeds the rate of growth. Citizens frequently block any move to remove trees, even when necessary for street widening. Small trees of the maple variety cause least trouble. If trees are already in the proposed median area, every effort should be made to preserve them.

Shrubs should be kept to a minimum and of a type that does not

obscure pedestrians, particularly small children. At least a ten-foot-wide area is needed because of the carbon monoxide, heat, and water. Shrubs of the crepe myrtle variety are a recommended type where climate permits.

Grass should not be planted in medians less than ten feet wide. Cutting and growth both become major problems on medians of less width.

Where underground storm sewers do not exist, depressed medians serve this function and improve traffic conditions provided satisfactory drainage conditions are available.

Accidents Along Medians Analyzed

All reported accidents at 356 intersections and along the 29.4 miles of streets with median strips were analyzed. In Richmond, an accident involving city property, a fatality, an injury, or $50 property damage must be reported. These records cover the period from January 1, 1947 to July 1, 1953.

The major causes of accidents involving median strips were excessive speeding, passing, turning into the median from a side street, drinking, and inattention.

A high incidence of accidents involved trees and utility poles that were three feet or less from the curb line. Without the curb this rate was higher. Where there were no trees, injuries and fatalities were fewer.

Few accidents involved vehicles which completely crossed the median. In these accidents, excessive speed was the main factor. All four reported fatalities resulted from collision with trees.

From 1947 to 1952, no median strip existed along Broad Street. Steel trolley poles stood in the center of the street from the 12th to Sheppard Streets, a distance of 2.84 miles. During this five-year period, 82 accidents, 34 injuries, and $21,460 in property damage resulted from accidents involving these poles. In the one year since the median was installed along 1.24 miles, only one accident involving two injuries and $1,500 property damage has been reported. It will be interesting to study the accident rate after the median is completed for the full distance now under construction. The Bureau of

Traffic Engineering estimates a 90 percent reduction in accidents of this type during the next five years.

Safety treatments at the end of medians include signs, reflectors, delineators, painted curbs and pavement lines. The most effective sign has been the reflectorized crosshatch and directional arrow type, 24 inches wide and 36 inches high which has been generally installed approximately 18 inches from the median surface. Where curbing does not exist, upright granite sections or wooden barricades prevent encroachment and preserve the ends from damage.

Miscellaneous Details on Median Study

Fire Bureau officials indicate that no median in Richmond has resulted in material delay to firemen responding to fire alarms. A fire plug located in the center of a ten-foot median serves pumpers efficiently from both directions. If the median is over twelve feet, the suction sleeves cannot be extended from the pumper while parked next to the median curb without the coupling of two sections. This is an awkward arrangement and is time-consuming. Median strip fire plugs are rarely blocked by parked vehicles.

Reference to the limited traffic volume data on Broad Street with and without a concrete median shows an increased percentage of the total volume using lanes adjacent to median strips. These data are not extensive enough to prove this fact conclusively but do establish a trend. This study appears to support the contention that median strips increase street capacity.

24-Hour Traffic Volumes on 6-Lane Thoroughfares

With 4-foot Concrete

Direction of Trend	*Lane Next to Median*	*Total Flow All Lanes*	*Percentage of Total Flow*
Eastbound	2,340	9,282	25
Westbound	3,545	11,129	35

Without 4-foot Concrete

Direction of Trend	*Center Lane (No Median)*	*Total Flow All Lanes*	*Percentage of Total Flow*
Eastbound	4,482	19,981	22
Westbound	3,094	19,906	16

Note: Left turns permitted at intersections.

Spot speed checks on Broad Street of traffic traveling along center lanes adjacent to the median indicated that the relative maximum, 85 percentile and minimum speeds do not vary materially with or without median strips during the day or night. Time did not permit the accumulation of extensive data.

SPOT SPEED SURVEYS

Center Lane—No Median

Day

Number of Observations	*Direction*	*Time*	*Speed in M.P.H. Maximum*	*85 Percent*	*Minimum*
50	Eastbound	4:15 p.m.	60	40	30
50	Westbound	4:15 p.m.	50	37.2	30
		Night			
50	Eastbound	9:15 p.m.	42.9	37.5	27.2
50	Westbound	9:15 p.m.	42.9	31.6	27.2

Center Lane Adjacent to Median

Day

50	Westbound	3:30 p.m.	50	37.5	25.0
50	Eastbound	3:30 p.m.	50	40.0	27.2
		Night			
50	Westbound	8:30 p.m.	40	33.3	27.2
50	Eastbound	8:30 p.m.	40	37.5	27.2

Legal Speed Limit 25 m.p.h.

Tests are now in progress to determine the relative distance motorists will travel in the center lane adjacent to medians of the following types:

a. Concrete
b. Raised Curbing
   1. Grass only
   2. Trees less than 24 inches from curbing
   3. Trees over 5 feet from curbing
c. No Curbing
   1. Grass only
   2. Trees less than 24 inches from curbing
   3. Trees over 5 feet from curbing

In Richmond, median strip openings or crossovers are not provided as a matter of policy except:

1. At intersections, excluding alleys.
2. At fire stations, police stations, hospital and other emergency entrances.
3. Opposite improved drives extending to remote properties used by heavy volumes of traffic.
4. Every 2,000 feet, where intersections do not exist and the roadway is not a limited access thoroughfare. Until this policy was adopted, numerous requests were received for median strip openings from parking lot, service station and industrial establishment operators.

Special local advantages of median strips include:

1. Beautification of residential areas.
2. Shade and health benefits.
3. Possible building of fine monuments on wide medians.
4. Provision of left-turning and deceleration lanes.
5. Better channelization of traffic and gradual aligning of vehicles at abrupt curves.

Special disadvantages are that:

1. Additional policing is required.
2. Trash accumulation occurs.
3. Maintenance of trees, grass, and shrubs is costly.
4. On abrupt median curve alignment, high accident rates occur.

When the Broad Street design plans were being formulated, the following suggestions were received: A raised curb with grass, shrubs and flowers; green or regular concrete; parking permitted in center —no median; painted white lines in center—no median; and installation of raised hinged metal plates covering underground pipes as a center median.

Finally, a six-foot concrete median not extending across crosswalk areas was selected because:

1. Minimum maintenance would be required.

2. Better traffic signalization, with dual overhead indications to each approach of traffic, could be maintained.

3. Heavy pedestrian movements occurred and were frequently trapped in the center of the intersection. With a six-foot median and a twelve-foot crosswalk, up to twenty-four pedestrians can be accommodated in the center area, assuming a three square-foot occupancy by each pedestrian.

The six-foot median is being extended approximately 1.6 miles. Also, an extension of .8 miles of the four-foot concrete median on Grove Avenue is under construction.

Median strips have definitely proved their worth in Richmond and should be strongly considered in all urban arterial construction where adequate rights-of-way can be acquired without excessive cost.

Correcting Traffic Difficulties

ROBERT J. ALLEN

Mr. Allen is Chief Traffic Engineer of the Insurance Industry Committee on Motor Vehicle Accidents. The Committee offers a free program of consultative assistance to all New York State communities in excess of 10,000 population in the development, formulation, and conduct of an integrated traffic safety program. Formerly Mr. Allen was Chief Traffic Engineer for the Accident Prevention Department of the Association of Casualty and Surety Companies. As a reserve officer in the U.S. Army Corps of Engineers he served in both the European and Pacific theaters during World War II, and was recalled to active duty during the Korean incident as Assistant Safety Director of the Second Army, and as Safety Director of the Engineering Section of the Far East command headquarters in both Japan and Korea. He is a member of the Institute of Traffic Engineers, of the American Society of Civil Engineers, and active on national committees in traffic safety work including the President's Highway Safety Conference, National Conference on Uniform Traffic Laws and Ordinances, and the Cornell University Medical College Advisory Committee on Auto Crash Injury.

IT WOULD be fine if we could state that all traffic difficulties could be readily corrected by simple means. Regrettably this is not the case. Many traffic problems are so complex that only comprehensive, often expensive, programs of improvement will provide the remedy. Sometimes these have to be pretty bold. Few jurisdictions are not confronted with localized problems that could be corrected by simply applying basic principles, techniques, and procedures proved effective by long experience.

Traffic Program Basic Deficiencies

Two basic reasons underlie the failure to treat effectively more of these traffic situations of a kind susceptible to correction by relatively simple means. These two deficiencies—particularly found in community after community of sizes ranging upward to 100,000 population—can be summarized as first, the lack of an integrated traffic program efficiently administered; and second, the failure to secure

necessary public support to insure the implementation and ultimate success of requisite traffic improvement measures.

Far too many municipalities yet do not realize the seriousness of the traffic problem, and accordingly have not established a system of traffic administration to achieve maximum efficiency with the resources available. The net result is a hodge podge of uncoordinated traffic activities, an undefined overlapping of responsibilities and authority, the initiation of traffic measures predicated on opinion rather than on factual analysis by qualified personnel, and ever-increasing traffic congestion and accidents.

It is frequently forgotten that traffic control is in the public interest since all members of the populace are concerned—either directly or indirectly. For this reason, traffic improvement measures must be developed that will provide the greatest benefit to the majority of citizens, even though a small minority may realize some disadvantages. Rare is the community where proposed traffic measures, for example, one-way streets and curb parking prohibition, have not stirred up vociferous opposition from various groups and individuals. Experience reveals, though, that those communities having an informed public support group to develop public opinion in favor of sound, practical traffic measures, almost inevitably approve the needed program. An interesting sidelight has been that in most instances, the original dissenting groups and individuals have thrown their full support behind improved traffic control measures once they have been placed in effect and proved their worth in alleviating congestion and reducing accidents.

Successful Traffic Control Measures

It is not the intent, however, to elaborate on these common traffic shortcomings of communities. Instead, it is hoped that presenting some simple methods that have actually proved successful in correcting traffic difficulties will aid officials faced with similar problems. Examples have been taken from the "Getting Results Through Traffic Engineering" bulletins published periodically for the last fifteen years by the Accident Prevention Department of the Association of Casualty and Surety Companies.

Distributed as a public service to more than 2,000 traffic engineers, police, and other officials directly concerned with traffic, these bulletins have proved an invaluable media for the interchange of ideas on correcting traffic difficulties. The projects presented here represent only a few of those employing relatively simple and inexpensive improvements. It is interesting to note that almost without exception these successful applications of traffic engineering principles and techniques have been effected by progressive communities that have adopted a sound system of traffic administration and have taken necessary steps to keep the public informed of needed improvements.

Wilmington, Delaware, Uses One-Way Streets

Excessive congestion from double and even triple parking caused by warehouses and merchandising distributing centers was the rule rather than the exception along French and Walnut Streets, two adjacent parallel streets on the edge of the business district. Heavy mixed traffic experienced inconvenience and delay on both streets, though it was greatest on French Street which carried part of route U. S. 13.

The trial of more severe parking regulation and enforcement did not materially relieve the congestion, while the unequal block lengths hindered most effective signal timing. Despite the fact that sixty accidents occurred in a year's time, of which twenty-seven involved pedestrians—eight between intersections—the degree of congestion and potential hazard rather than the high accident frequency determined the final corrective action taken.

Both streets were converted to one-way operation between 16th and Front Streets, embracing fifteen city blocks on each thoroughfare. This permitted the distribution of route U. S. 13 traffic to both streets, providing virtually a fifteen-block dual highway through a busy district, with the block between French and Walnut Streets functioning as a center island (Figure 1). The traffic signals were retimed to handle one-way movement smoothly. An intensive public information program was carried out in advance of this project, with widespread newspaper publicity pointing out the advantages of one-

way streets prior to their adoption. In addition, city officials called on the heads of each business establishment on the streets in question to explain the reasons for the desirable change.

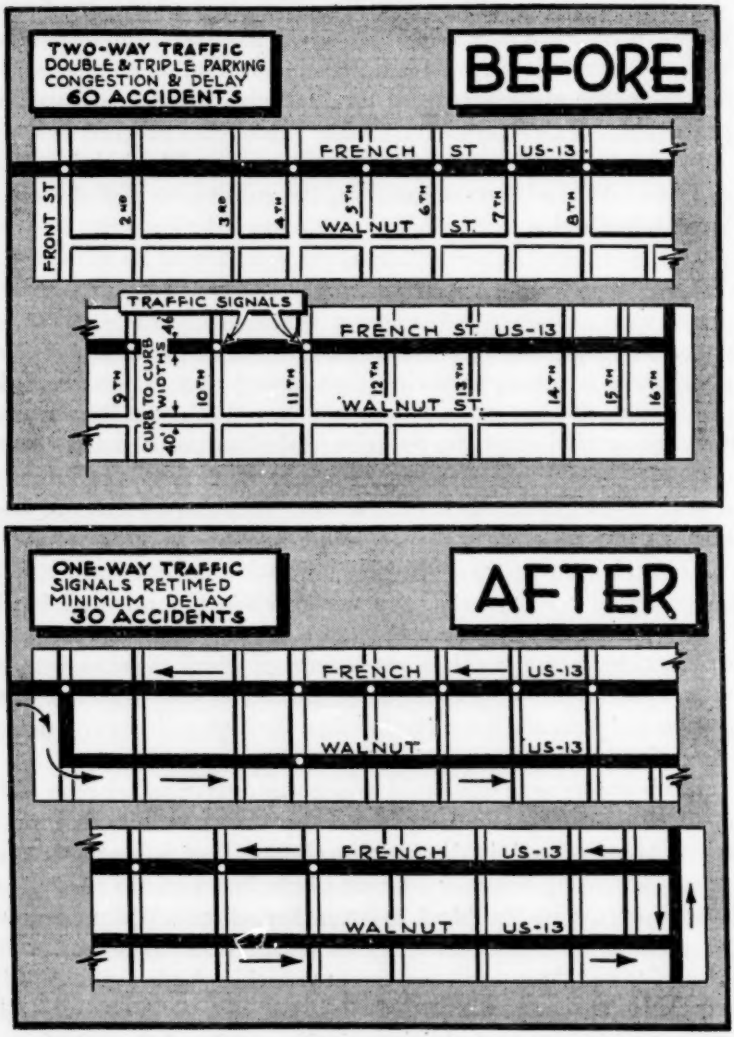

FIGURE 1. One-way streets reduce congestion and accidents in Wilmington.

The results exceeded even the highest expectations. The traffic capacity of both streets was materially increased and traffic flowed smoothly and unimpeded. In addition, accidents were reduced 50 percent during the subsequent year with only thirty accidents reported of which eleven involved pedestrians—only three occurring between intersections. This improvement was obtained for an expenditure of $175 for installing one-way signs.

Buffalo, New York, Marks Overpass Piers

Many railroad viaducts overpassing city thoroughfares were found to be locations of high accident frequency. Most of these viaducts had piers in the center of the roadway marked only by two small red reflectors about four feet above the pavement. Records revealed that the majority of accidents involved vehicles colliding with the viaduct piers. Significant were reports from many of the motorists involved that they mistook the red reflectors for tail lights on moving vehicles. At a typical overpass there were thirteen accidents during a two-year period, one of which was fatal, ten caused personal injury and two, property damage only.

The remedy included the installation of three amber signals on the center pier facing each approach, two of which were flashing amber and the third, constant amber. The center piers were also painted with reflectorized black and white six-inch diagonal stripes, while pavement markings were applied from the roadway center line to a point to the right of the center piers. (Figure 2). The success of this treatment at a cost of $266 was evident in the subsequent two-year period when only one minor property damage accident was reported—a reduction of 92 percent.

Signal Corrected in Burlington, Iowa

The signalized Y-intersection of Agency and Osborn Streets was the scene of five accidents within a year. Both streets were thirty-nine feet wide with Osborn Street marked for three lanes, the middle lane reserved for left-turns into Agency Street. Entering traffic volumes totaled only 473 vehicles for the two hours between 3:00

and 5:00 P.M., while the left-turn volume for the Agency-to-northbound Osborn movement was only two vehicles per hour. The signals were timed to display green indications simultaneously to

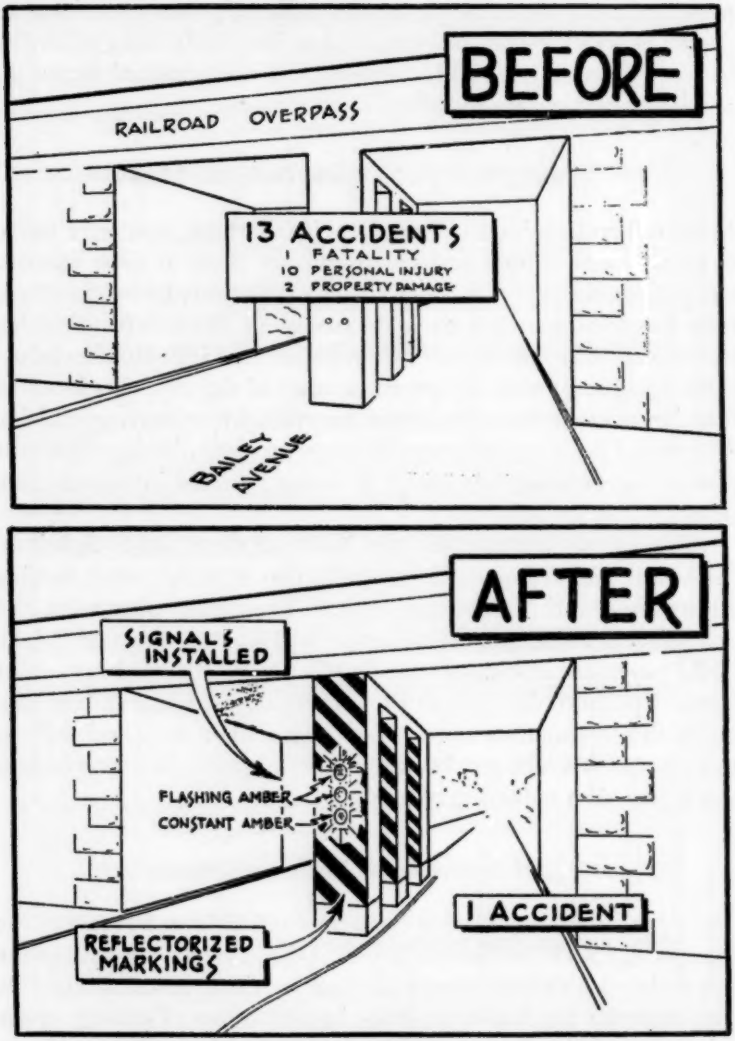

FIGURE 2. Signals and markings on overpass piers reduce accidents in Buffalo.

through-northbound Osborn traffic and to the extremely minor left-turn movement from Agency into northbound Osborn. (Figure 3). Despite this almost neglible left-turn movement, four of the five personal injury accidents reported involved collisions between these left-turn and northbound movements.

Soon after a traffic engineer was employed by the city, the improper signalization of this intersection was recognized—volumes fell far below the minimum warrants for the installation of traffic signals at urban intersections as recommended by the Manual of Uniform Traffic Control Devices for Streets and Highways. The signals were turned off for a trial period and stop signs were installed to control traffic entering from Agency Street. This improvement, made at negligible cost, proved more efficient and less hazardous than the unwarranted and improper traffic signal control, with the result that no accidents occurred during the initial six-month period following the change.

Berkeley, California, Installs Left Corner Signals

The intersection of routes U. S. 40 and California 24 daily accommodated more than 30,000 vehicles at prevailing approach speeds from 25 to 35 miles an hour. Traffic was controlled by single-head signals mounted on the far-right corners. This location was the scene of an average of ten personal injury accidents each year over an eight-year period. Enforcement records revealed a continuing high frequency of traffic signal violations even though traffic was predominantly non-transient in nature.

On-the-spot studies of signal visibility showed that the single far-right signal indications were frequently obscured from the drivers' view by large trucks and buses traveling in the right-hand lane of these two routes, respectively 74 feet and 46 feet wide between curbs. Accordingly, four additional signal heads were installed on the far-left corners at a cost of $300. Signal violations decreased until almost non-existent and the three personal injury accidents reported during the following year—two of which involved drunken drivers—represented a 75 percent reduction from the twelve accidents occurring during the previous year.

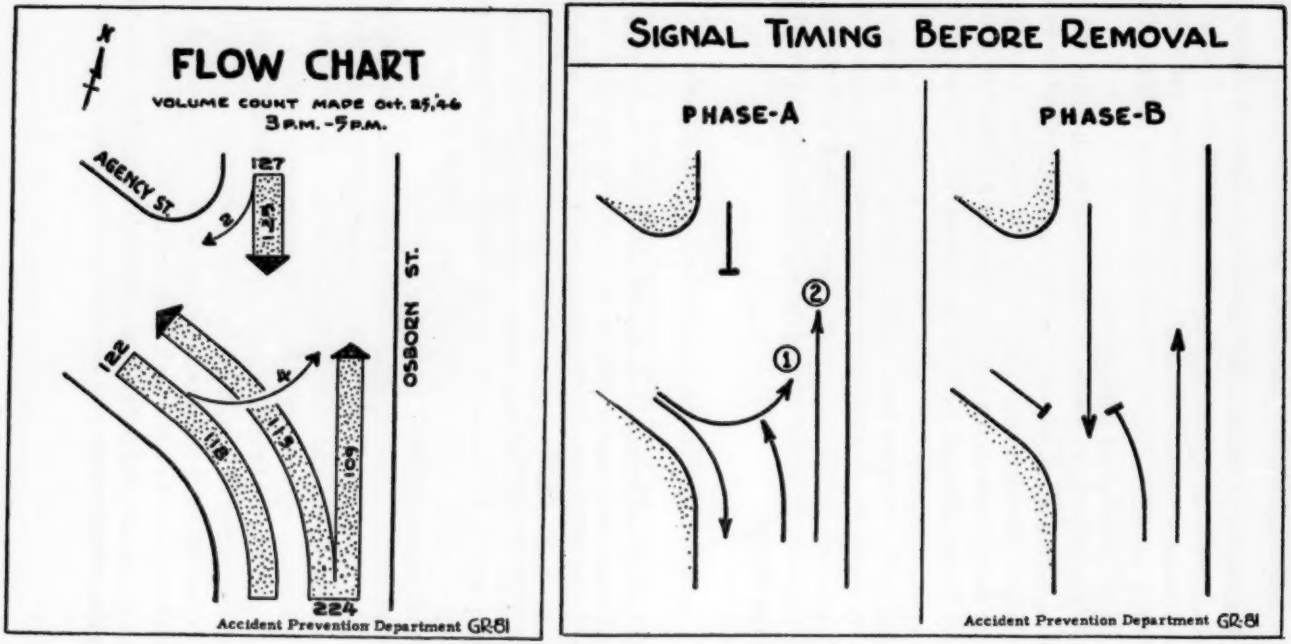

FIGURE 3. Burlington, Iowa, removes improper signal control.

South Bend, Indiana, Re-locates Bus-Loading Zones

Near-side curb bus-loading zones restricted the number of lanes available for moving vehicular traffic, and particularly obstructed turning movements at a number of important signalized intersections. The result was congestion rapidly increasing, and traffic frequently at a standstill. The north approach of Michigan Street at Washington Avenue was selected for this example as being typical of many other locations. Michigan Street was 33 feet between centerline and curb, providing ample width for three traffic lanes at the intersection approach, but bus-loading within 20 feet of the crosswalk narrowed the effective approach to two lanes. The peak volume southbound on this approach for the average weekday was 760 vehicles an hour with turning movements averaging 31 percent of this flow. Delay studies revealed that on the average only eight vehicles cleared the intersection on a 19-second green interval. Often, when the lead vehicles desired to make turning movements, only five vehicles were able to proceed through the intersection.

Bus-loading zones were moved back ninety feet from the crosswalk, making all three lanes of the approach available for moving vehicular traffic, permitting turning movements with a minimum of delay to through-traffic. This relocation necessitated eliminating five parking spaces along the approach. Despite an increase of over 11 percent in traffic volumes during the following year, traffic flow was much more efficient, to the extent that as many as twenty-two vehicles frequently cleared the intersection on a 19-second green interval. When turning movements were made by the lead vehicles, as many as fifteen vehicles were still able to proceed through the intersection. In addition to substantial decrease in congestion, accidents on this approach dropped 25 percent.

Four-Way Stop Helps in Nashville, Tennessee

The normal right-angle intersection of 8th and Jo Johnston Avenues was typical of many such intersections, in that visibility on all approaches was critically restricted by existing buildings at each corner. Traffic control consisted of 24-inch reflectorized stop signs

on Jo Johnston Avenue. Traffic volumes ranged from 500 to a maximum of 800 vehicles an hour during the day, divided almost equally between the two streets. During a seven-month period, there were ten accidents of which four resulted in personal injuries. This high accident experience caused considerable agitation on the part of the uninformed public for the installation of traffic signals.

This solution could not be justified under any of the warrants in the Manual on Uniform Traffic Control Devices except possibly that of accident hazard. Traffic signals, however, are one of the most restrictive types of control devices and should not be installed until an adequate trial of less restrictive remedies, with satisfactory observance and enforcement, has failed to correct the situation. It was therefore decided to try correcting the accident problem by making this a four-way stop intersection. Reflectorized 24-inch signs reading "4-Way Stop" were installed on the 8th Avenue approaches and the legend "4-Way" was added to the existing stop signs on Jo Johnston Avenue. Because of the blind corners, it was deemed necessary to call additional attention to the four-way stop requirement. This additional emphasis was provided by 48-inch reflectorized stop signs made out of all-weather plywood, suspended from span wires over the center of each roadway. The legend "4-Way Stop" was placed on both sides of these signs, thus necessitating only two signs—one on each roadway—which provides a near-side indication to traffic on one approach and a far-side indication on the opposite approach. This project, costing $34, resulted in a 70 percent reduction in accidents during the seven-month subsequent comparable period. Of these three accidents, two were rear-end collisions occurring within a few days of the installation before drivers had become familiar with the new control.

Mid-Block Bus Loading in Shreveport, La.

Center-of-the-street loading of trolley-coaches on the main artery in the central business district created a serious pedestrian hazard and caused undue congestion and delay to motorists at intersections. Texas Street was 72 feet between curbs and marked for two lanes of parallel curb parking and six lanes of traffic movement. Trolley-

coach loadings were conducted in the centerline lane on the near side of the intersections, but there were no loading islands to protect transit patrons. Pedestrians endangered their safety, particularly during inclement weather, by waiting till the last minute before the approach of the trolley-coach to dash from the sidewalk to the painted loading zone, disregarding vehicular traffic and traffic signals. The frequent overflow of passengers outside the loading zone increased the hazards of pedestrian-vehicular conflicts, which resulted in numerous minor accidents and one serious pedestrian injury.

Serious congestion and delay to traffic movement also occurred at the intersections since the center-line lanes were frequently blocked during the green signal indication because of loading operations. Motorists desiring to make left turns were delayed, with the result that they frequently invited accidents by attempting left turns from the middle lanes. The milling about of transit patrons with pedestrians crossing the street increased the required pedestrian clearance time, thus delaying vehicular traffic given the green signal.

An analysis of conditions resulted in the decision to move the trolley-coach loading zones to mid-block locations at the curb. The transit company agreed to erect concrete platforms level with the sidewalk and extending six and one-half feet out from the curb. The plan to extend the platforms out into the street was adopted to save approximately ninety feet of curb space that would have been unavailable for parking if the trolley-coaches were required to swing into and away from the curb line. This arrangement permitted the use of minimum length loading areas—forty-four feet for single coach loading and eighty-eight feet for double loading. The end of the platforms are protected from moving traffic by parked vehicles during the day and at other times by the use of reflector buttons and a red light. Delays to intersectional traffic flow were materially reduced by the decrease in pedestrian crossing congestion and by the availability of three lanes in each direction for vehicular flow. The transit company reported that trolley-coach delays due to congestion were reduced 50 percent. In addition, the sidewalk congestion at intersections from loading operations was relieved. No accidents involving loading operations were reported during the first eight months.

Intersection Efficiency Improved in Schuyler, Nebraska

The junction of routes U.S. 30 and Nebraska 15 was a normal right-angle intersection with adequate sight distance on all approaches, in a primarily residential area. Single-face traffic signals had been installed on the far-right corners some years previously. Traffic volumes totaled over 3,600 vehicles for a 24-hour period of which approximately 2,500 operated on U.S. 30. The 85 percentile speed was 36 miles an hour despite a posted 25 mile zone. Speed and delay studies to determine the amount of inefficiency of intersection operation due to unnecessary signal delay revealed that 53 percent of the vehicles entering the intersection were stopped for an average of 13.9 seconds each, of which 13.3 seconds' delay was due to signals alone. This meant approximately six hours of unnecessary daily delay to traffic.

Analysis of the conditions showed that the traffic signals were not justified on the basis of the minimum warrants for fixed time signals recommended in the Manual on Uniform Traffic Control Devices. Further evidence of the ineffectiveness of the signals was furnished by the fact that the majority of the eleven accidents reported during a year had been right-angle collisions between vehicles on the intersecting streets—a type of accident which properly warranted and obeyed signals should normally prevent. Analysis also showed that this intersection was experiencing eight times as many accidents as was a similar location also on U.S. 30 where only stop signs were used to control traffic. In addition, the average vehicular delay due to stop signs at the other location ranged only between four and five seconds.

Accordingly, the traffic signals were removed and 48-inch reflectorized stop and "Stop Ahead" signs were erected to control traffic on Nebraska 15. As a result of the speed-study findings, the area was re-zoned for a speed limit of thirty-five miles an hour. Then the traffic flow was speeded up because the stop signs brought delay to only 32 percent of the traffic, resulting in approximately only one-sixth as much daily delay. The accidents were reduced 91 percent in the comparable following year with only one minor accident reported.

Denver, Colorado, Makes Traffic Safer for $75

The intersection of Speer Boulevard and Stout Street, located in a commercial zone, carried a relatively large amount of mixed traffic at better than average speeds. The observed 24-hour average daily traffic was 10,000 vehicles on Speer Boulevard and 5,250 vehicles on Stout Street, while average prevailing speeds were 35 and 25 miles an hour respectively. There was no traffic control of any nature at this location which was the scene of thirty-six accidents—predominantly right-angle collisions—during a six-month period. A major contributing source of the trouble was motorists' uncontrolled parking along the curbs right up to and sometimes actually within the intersection, which critically restricted approaching drivers' sight distance. In addition, several unimproved plots of city property along Speer Boulevard were also used for haphazard parking, which resulted in several accidents from vehicles' leaving these spaces and entering the traffic stream at unexpected locations along the block. (Figure 4)

It was decided to give the major and faster moving traffic on Speer Boulevard the right-of-way, and accordingly standard reflectorized 30-inch stop signs were erected to control traffic on Stout Street. Curb parking was prohibited a sufficient distance back from the cross walk on each approach to provide adequate sight distance for safe operation. The uncontrolled parking on the open lots was eliminated by the erection of barriers, 3½-inch diameter wooden posts 2 feet 9 inches in height, on which were mounted 3 x 6 inch reflectorized red panels. Standard pavement markings of center lines, stop lines, and cross-walk lines were painted to provide for more efficient traffic control. This project, which cost only $75, resulted in the complete elimination of accidents during the following comparable six-month period. In the two subsequent years, only eight minor accidents were reported annually despite an increase in traffic demands.

Five-Way Intersection Revamped in Charlotte, N. C.

The five-way intersection of East Trade Street, McDowell Street, and Elizabeth Avenue was the scene of considerable confusion, seri-

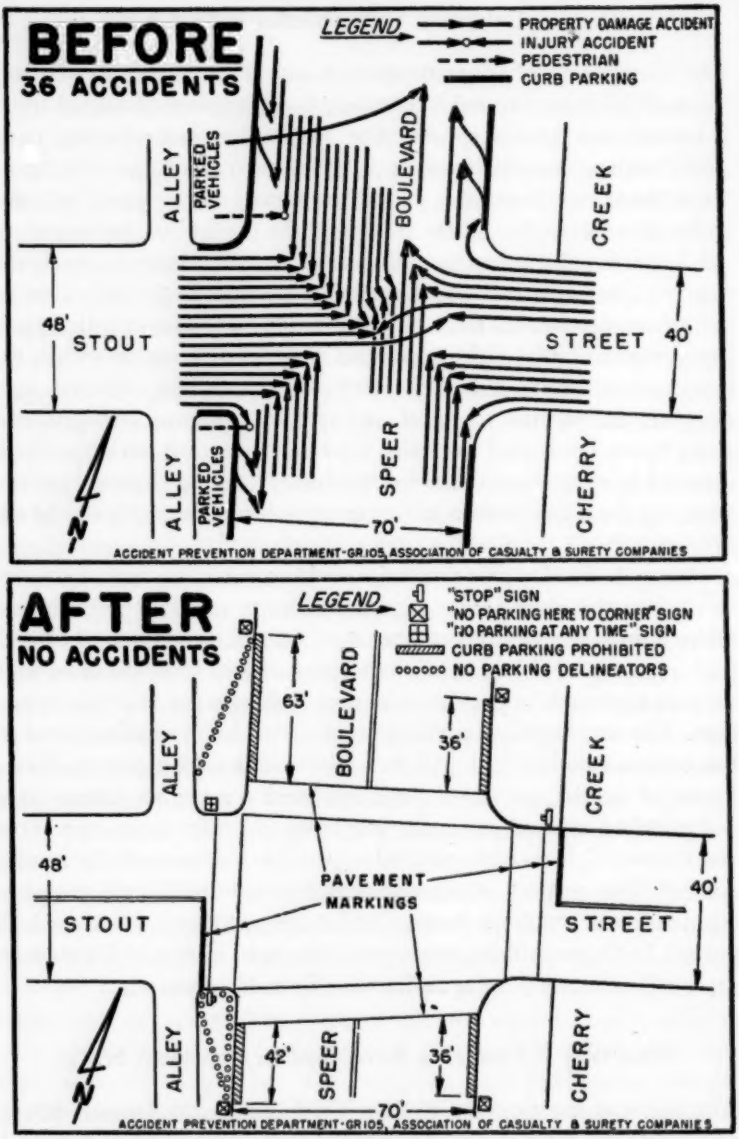

FIGURE 4. Restricted parking and traffic control help Denver's cross traffic.

ous congestion, and high accident frequency common to multiple-approach intersections. Two-way traffic movement was permitted on all five approaches which varied in width as follows: Elizabeth Avenue, 40 feet; McDowell Street, 37.5 feet; East Trade Street, 50 feet and 36 feet wide west and east, respectively, of the intersection. Traffic control consisted of a small triangular island and a span wire, center-suspended, four-way adjustable signal. (Figure 5). Traffic on

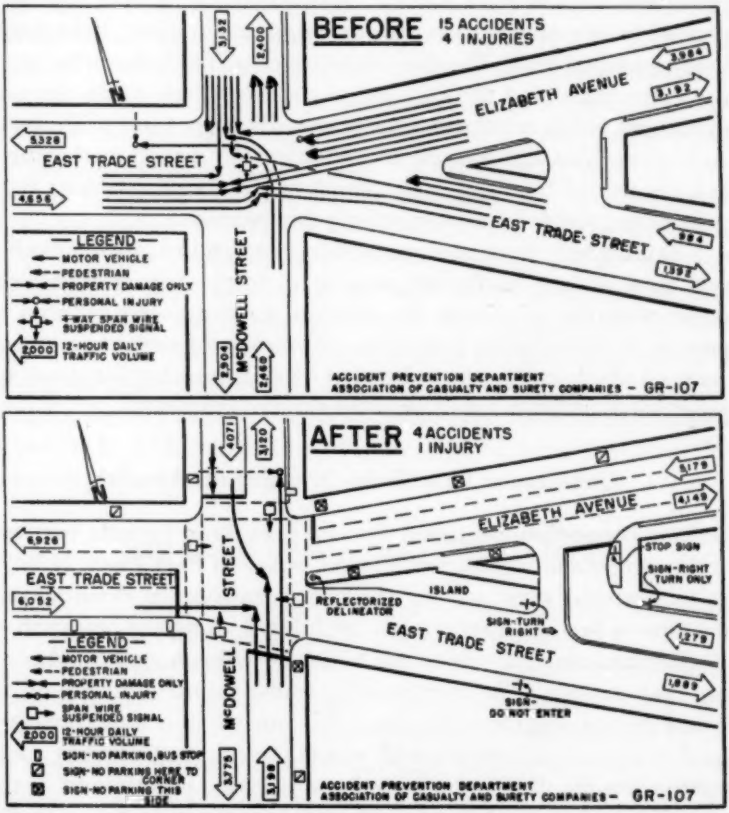

FIGURE 5. Revamped five-way intersection reduces accidents 73 percent in Charlotte.

Elizabeth Avenue and East Trade Street moved simultaneously under a two-phase signal operation which caused a converging conflict

of westbound traffic. The average daily 12-hour traffic volume was more than 15,000 vehicles. Fifteen accidents were reported during a year.

The decision was made to redesign the intersection, and accordingly the existing channelization was completely revamped. A new 6-inch raised concrete channelizing island was installed which also provided a sidewalk along the north side to permit pedestrians to travel east on Elizabeth Avenue. Individual signal faces were suspended from span wires over the driving lanes in place of the single four-way signal head. The short section of East Trade Street between the intersection and the east end of the island was made one-way eastbound, while westbound traffic on this street now turns north and enters Elizabeth Avenue at approximately a right angle where it is controlled by a stop sign. Standard pavement markings were painted to provide for a more orderly flow of traffic.

This improvement, at a cost of $680, resulted in a much smoother and more orderly traffic flow despite an increase in average daily traffic of almost 25 percent. In addition, accidents were reduced 73 percent in the following year when only four accidents were reported —one of which involved a pedestrian illegally crossing the street approximately thirty-five feet from the marked crosswalk.

Unbalanced Flow Helps Washington Arterial

Serious congestion prevailed during peak flow periods between Irving Street and Rock Creek Church Road on Park Place, N.W., a 36-foot arterial street serving the eastern portion of Washington's Northwest Section. Parking was prohibited along the east curb at all times and along the west curb during both the morning and evening rush periods. The average daily traffic volume (7:00 A.M. to 6:00 P.M.) passing the midpoint of this one-half mile long congested section was 11,196 vehicles, with a peak hour average of 1,643. Congestion was the daily occurrence because traffic southbound in the morning rush period (1,092 vehicles) was twice as heavy as the northbound traffic (503 vehicles), while the opposite condition prevailed in the evening rush hour—northbound vehicles totalled 1,165 while southbound vehicles averaged only 460.

It was realized that congestion could only be relieved on the existing facility by allocating available street space proportionate to the traffic demands during both peak traffic periods. Therefore, a system of unbalanced flow employing the technique of reversible lane movement was proposed for peak period operation. This system provided for two lanes southbound one lane northbound in the morning peak from 7:00 A.M. to 9:30 A.M., and two lanes northbound and one lane southbound in the evening peak from 4:00 P.M. to 6:30 P.M. Traffic lanes were painted with white paint of a quality that would wear off rapidly under traffic in the event the unbalanced flow system did not prove effective. Later, when the success of the project was evident, the lane lines were repainted with a good quality paint. Traffic signs bearing the message "One Lane 7–9:30 A.M.—2 Lanes 4–6:30 P.M." were erected for northbound traffic (signs with the opposite message erected for southbound traffic) at the far side of each intersection to insure that drivers of vehicles turning into Park Place, N.W. were apprised of the method of operation. Oversized 24 inch x 30 inch signs were installed at the beginning points, while signs at all intermediate intersections were 18 inches x 24 inches. At a cost of $300, this system almost entirely eliminated congestion despite the fact that evening rush-hour traffic volumes increased 17 percent. In addition, left-turning movements from the heavy-flow direction were made substantially easier.

Jacksonville, Florida, Corrects U.S. 1 Hazard

Old Kings Road enters route U.S. 1 at an angle of thirty degrees to form a "Y" intersection at a point where southbound U.S. 1 narrows from a four-lane divided highway (four 10-foot lanes with a 10-foot medial strip) to a two-lane 24-foot undivided pavement. U.S. 1 carries relatively heavy, mixed, high-speed traffic continuously since it is the main north-south artery through the city. Average 10-hour volume is about 5,000 vehicles, of which approximately 12 percent is commercial. Speed studies on the north approach of U.S. 1 showed the 85 percentile speed of southbound traffic to be 53 miles per hour. Traffic control consisted of an overhead suspended beacon showing flashing yellow to northbound and southbound traffic on U.S. 1 and

flashing red to traffic approaching the intersection on Old Kings Road. The majority of the twelve accidents reported during an eleven-month period—resulting in injury to thirteen persons and property damage of $14,160—involved southbound vehicles on U.S. 1 failing to negotiate the sharp turn to the left, and vehicles on Old Kings Road failing to stop before entering the intersection (Figure 6).

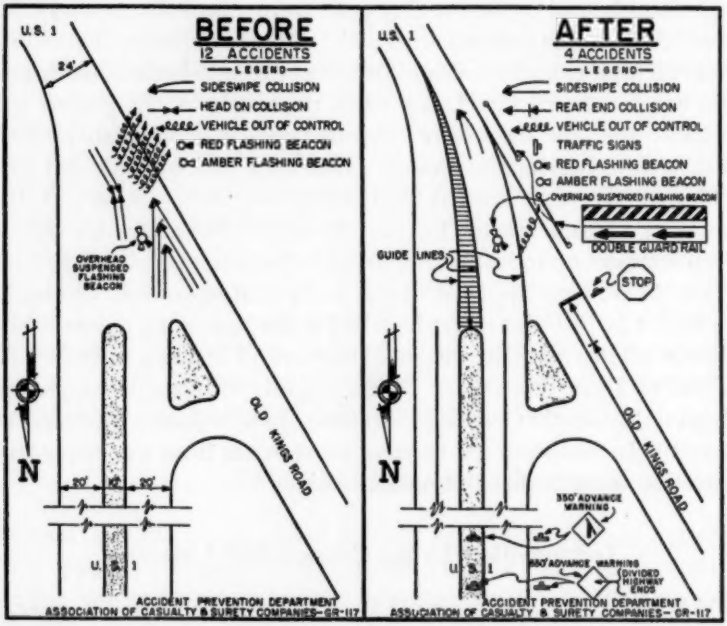

FIGURE 6. Adequate warnings of narrowing pavement cut losses in Jacksonville.

Analysis of the situation indicated that adequate warning of this hazardous intersection was not being provided for motorists. A simple program applying basic traffic control devices was therefore developed. The obsolete flashing beacon was replaced with a new flasher visible to motorists for 500 yards in advance of the intersection. Solid white reflectorized 12-inch guide lines were painted around the curve on U.S. 1 to delineate the outside edge of the curve and to warn of the transition from divided to non-divided pavement.

Southbound traffic on U.S. 1 was furnished additional warning of the curve by the erection of two sections of guard rail on the outside shoulder. These rails consisted of reflectorized panels showing diagonal yellow and black stripes and black arrows on a yellow background. An oversized 42 inch x 42 inch reflectorized stop sign and supplementary stop line were installed on the minor approach.

In addition, reflectorized warning signs were installed well in advance of the intersection on the north approach of U.S. 1 to indicate the end of the divided pavement and the approaching "Y" intersection. This simple treatment proved highly effective in preventing accidents as evidenced by the 67 percent reduction during the comparable subsequent period. The four reported accidents injured only three persons and caused an estimated $3,745 property damage —both a reduction of over 70 percent. Thus the economic savings realized in reduced property damage losses alone quickly repaid many fold the $255 that this improvement cost.

It should be readily obvious that the traffic situation in many communities has been greatly improved by simple remedial measures. While it should be reiterated that naturally all traffic problems are not of a nature that will permit solution through basic means similar to those outlined, scores of localized situations throughout the country can effectively benefit from the application of simple, inexpensive correctives. As evident from the successful projects described, significant advances in progressive traffic control could be realized through the proper and judicious use of the basic tools of the traffic engineering profession—signs, signals, and markings—where factual analyses by qualified personnel found them to be justified. Until those principles and techniques of proved effectiveness receive universal application at all levels of the traffic problem—state, county, and municipal—we shall not be able to state that real progress in traffic improvement is being realized.

Loading Experience as a Basis For Zoning Requirements

KENNETH GREEN

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PORTLAND, Oregon, is processing a new zoning code. The Planning Commission is the agency responsible for the technical aspects. An important element of the code is the article dealing with loading requirements.

A consultant already had worked on the zoning code, but the Planning Commission and Portland's Bureau of Traffic and Transportation were dissatisfied with the article on loading areas. The proposed article quoted from the code follows:

"Article 19: LOADING AREAS, Section 6–1901.

LOADING SPACE. Every hospital, institution, hotel, commercial or industrial building hereafter erected or established on a lot which has an area of ten thousand (10,000) square feet or more shall have one (1) permanently maintained loading space of sufficient area that no vehicle of any kind when using such loading space shall project into any public right-of-way. There shall be an additional loading space for each additional ten thousand (10,000) square feet or fraction greater than five thousand (5,000) square feet."

Such a requirement does not reflect the fact that different general uses of the land require different quantities of loading berths. It seemed apparent that a requirement had to be devised to reflect these differences. Three sources of information could be definitely drawn upon:

1. A loading zone survey conducted by the Bureau of Traffic and Transportation* in the Portland central business district.

2. A land use survey conducted by the Office of the City Planning Commission* in the Portland central business district.

3. The Atlases of the Sanborn Map Company.

These sources were not developed with the revision of the loading requirement in mind. Thus it was necessary for the staffs of the planning commission and the traffic bureau to integrate those sources through study and cooperation. This cooperative integration, effectively accomplished, resulted in a more equitable loading requirement.

Selective Appraisal of the Central Business District

The loading survey conducted by the traffic bureau was conducted within the central business district. This business district serves a corporate city of 373,628 people. Multnomah County, including the city of Portland, contains a total of 471,537 people and the four-county economic region[1] for Portland contains a population of 704,829. Needless to say, Portland is in terms of population and socioeconomic focus the dominant city of the State of Oregon.

The pros and cons of what the limits of the central business district are will not be discussed in this article as such limits will depend in large part on the problem. The hard core of the district was covered by the loading zone survey; certain peripheral sections were not. An example of such a section would be the north side of Burnside where extensive facilities exist for the sale and servicing of motor vehicles.[2]

The nature of the uses of the land in the *loading survey area* are described in terms of *square footage of net floor and ground area* in Figure 1. Not including the blocks split by the survey line be-

* For the sake of brevity these departments will be termed respectively Traffic Bureau and Planning Commission.

[1] The United States Department of Commerce definition of the Portland Economic Region includes the counties of Washington, Multnomah, Clackamas, and Clark (State of Washington) and this article recognized this definition.

[2] Assuming of course that such commerce is a proper peripheral component of a central business district.

tween S.W. Madison and S.W. Jefferson Streets the survey encompassed one hundred and fifty-two blocks with the characteristic block

W. BURNSIDE
S.W. 14th AVE.
STUDY AREA BOUNDARIES
S.W. FRONT AVE.
WILLAMETTE RIVER
S.W. MADISON ST.
S.W. JEFFERSON ST.
RETAIL & SERVICE — 4184430 SQ. FT.
OFFICE & BANK — 4146500
HOTEL — 2603000
PUBLIC & SEMI-PUBLIC — 1448400
PARKING — 1362000
WHOLESALE & STORG. — 1148200
XPORT & PUBLIC UTIL. — 572550
COMM. AMUS. — 363400
PARK — 120,000
AUTO SALE & SERV. — 92,000
SOURCE: SANBORN MAPS, LAND USE SURVEY CITY PLANN. COMM.
• BY GROUND & FLOOR AREA
OFFICE & BANK 26.0%
HOTEL 16.3%
PUBLIC & SEMI-PUBLIC 9.0%
PARKING 8.5%
WHOLESALE & STORAGE 7.2%
XPORT & PUBLIC UTILITIES 3.6%
COMM. AMUS. 2.3%
PARK 0.8%
AUTO SALES & SERVICE 0.6%
RETAIL & SERVICE 26.2%
ROUNDING ERROR .03%

FIGURE 1. Uses of the land in loading survey area.

being square and containing approximately 40,000 square feet of ground area.[3]

It is important at this point to ask whether the area encompassed by the loading survey was representative not only of the downtown area but of the city as a whole. On top of this it is important to ask whether the area will also reflect not only present uses in the city as a whole but future uses yet to be developed in Portland.

It is obvious that floor area in a central business district is, generally speaking, the most intensively used of any of the commercial areas within a city. More to the point there would be a greater need for off-street loading berths in the downtown area for a given amount of floor area than would be necessary for the other commercial areas.

The full effect of this intensity was not felt in the survey because of the nature of the procedures used, namely, conducting the survey on different days of the week and not on Saturday. On this basis, it was felt that while the intensity of floor area was an important factor, the dispersal of survey days caused a diminution of the *recorded* use of the loading zones significant enough to allow the survey to be used for the development of a general city-wide requirement.[4]

Not all commercial uses in the city were represented in the area of the loading zone survey. This factor was not sufficient to deter analysis since it was felt that there were enough uses represented to make a significantly more equitable loading requirement.

The next question is whether the uses within the area are representative of the uses still to be developed in Portland but not yet in actual existence. This is of course not known and it is only possible to evaluate the existing data and project into the future on the basis of that data. There is not much question that the requirements will have to be revised as new uses of the land develop, commercial districts change in nature, population increases, and other

[3] This loading survey was conducted under the supervision of the Traffic Engineer, Fred T. Fowler and the Assistant Traffic Engineer, Carlton C. Robinson.

[4] Retail stores might use loading facilities intensively Thursday or Friday to bring merchandise into the store and perhaps more intensively on Saturday to ship merchandise to customers. Surveys conducted on zones Monday to Wednesday inclusive might not truly reflect the highest use of the loading zone or zones. *While this factor is assumed to have had an important general effect, it is not assumed here that the effect was significant relative to individual zones and therefore to be construed as a criticism of the loading zone survey.*

events change the needs and desires of the people of Portland.

Some of the risk of error relative to the above discussion can be reduced if cities can exchange information on different uses of the land, but the great portion of the risk inherent in future development and the gearing of requirements to such development can only be evaluated and controlled by sensitive professional engineering and planning staffs operating in a progressive political climate.

The Loading Zone Survey

The loading zone survey was conducted to determine the degree of use of curb-loading zones. Through this study, the traffic bureau was to determine whether the zone was needed at all, should be reduced in length, or should be extended. The fact that made this survey pertinent to the discovery of loading experiences in the downtown district is that there are few off-street loading areas in this district. Those existing off-street areas were assumed insignificant, thus making way for the assumption that the loading that took place in the curb-loading zones was a substantial reflection of the loading experience of the uses of the land within the survey area.

One more assumption was necessary for the tying down of the relationship between individual blocks of land to the loading zones. The loading in zones on the periphery of a particular block reflected the loading experience of that block with such factors as across-the-street loading being considered unimportant.

Looking at the loading survey in more detail, it can be seen that it contained a great deal of information.

1. Number of vehicles entering loading zone.
2. Duration vehicles stayed in zone.
3. Kinds of vehicles using zone.
4. Length of loading zone.
5. Exact location of zone on periphery of block.
6. Exact date of survey for each zone.
7. Numbers of vehicles visiting zones by certain time periods within the hours of nine in the morning and six in the evening.

Fortunately, the traffic bureau had summarized this information on a map and this generalized form contained: the number of

vehicles visiting zone divided into classes, 0–5, 5–10, 10–15, 15–20, and 20 and over; the length of each individual loading zone within five feet, and the location of the loading zone on the relavent block.

The planning commission staff, realizing that this information in summary map form was general, still felt that the great mass of statistical analysis should be based on this summary because of the degree of precision of other data used in conjunction with the loading survey. Keeping in mind that the objective was a city-wide general requirement, extreme precision could serve only as an academic exercise at best, and at worst, generate a false confidence.

Land Use

Relative to sources of information pertinent to developing a loading requirement, the planning commission staff had Sanborn Maps and a planning commission land use survey (generalized) of downtown Portland. Using these sources, the planning staff did a block by block accounting of *floor area usage* in the loading zone survey area. In the course of the process, the Sanborns were used for detailed enumeration while the land use survey was utilized as verifier and classifier.

Ten use classifications were set up in order to group the mass of detail generating from the staff work on detailed enumeration of floor space usage. These classifications were retail and service, office and bank, hotel, public and semi-public, parking, wholesale and storage, transportation and public utilities, commercial amusement park, and auto sales and service.

These classifications were set up from the classifications used by the planning staff on its downtown land use survey (mentioned above) as this would be the only way available of both grouping and verifying the data in the Sanborns. Another land use survey oriented on the loading requirement specifically would have aided precision but was out of the question in terms of staff time and budget.[5]

[5] The planning commission survey of land use in the central business district indicated only the dominant uses of the land in each individual block and did not indicate all the various uses and square footages of floor space for same. Therefore, the planning staff concluded that it was too general to use alone without the Sanborns.

The classifications aided the grouping of amounts of data large enough to work with. If, for example, retail and service had been divided into ten cent stores, men's clothing stores, etc., significantly substantial data may not have been recorded for all of these small divisions. If data could have been recorded for such small divisions, better or perhaps more precise results would have been obtained, but this was not possible.[6]

Setting Up Data for Analysis

The setting up of the data for analysis generally described in the previous sections will be divided into three parts for purposes of discussion. One, a description of the table used for enumeration of data and for the computation of some minor data; two, a description of the summary cards utilized for the sorting of data; and three, a description of the technique utilized for evaluating whether the uses of the land are to be assumed as having additive or associative relationships relative to the effect on the generation of demand for space by vehicles loading and unloading in the pertinent curb loading zones.[7]

The table for the enumeration of the basic data to be used for the analysis took the form as shown in Figure 2. There is, however, a little more information necessary for a better understanding of this same table.

In order to understand what was happening in the spatial sense during analysis it was necessary to locate the individual blocks forming the group being analyzed. For this reason, it was necessary to identify each block by its plat number, the streets that formed its boundaries, and finally an arbitrary number [Column (3)] to establish a direct relationship between the block used in analysis and the location of this same block in the loading survey area.

[6] It will be shown later that the system of analysis used for the evolution of part of the loading requirement was a great time consumer; thus the more general the data could be kept, the progressively easier and shorter would be the work load necessary for analysis. If it had been necessary to break the data down into smaller divisions, the extended time necessary for analysis might have made the analysis necessary for a more equitable loading requirement impossible in terms of staff time and budget.

[7] Associative and additive as terms will be explained later in the text.

IDENTIFICATION AND REFERENCE

Plat Block No.	*Sanborn Volume and Page Number*	*Block No. for Stat. Analysis*	*Street Boundaries of Block*
(1)	(2)	(3)	(4)
S½85	Vol. 1, p. 78	59	Oak, Stark, Park, and Broadway

NET FLOOR SPACE USAGE BY BLOCK IN SQUARE FEET

Off-Street Parking	*Public and Semi-Public*	*Wholesale Storage*	*Transportation and Public Utilities*	*Auto Sales and Service*	*Commercial Amusement*
	H*	G*	F*	E*	D*
(5)	(6)	(7)	(8)	(9)	(10)
(None)	15,000	(None)	145,000	(None)	(None)

NET FLOOR SPACE USAGE (Continued)

Office and Bank	*Retail and Service*	*Hotel*	*Notes and Comments*	*Notes and Comments*
C*	B*	A*		
(11)	(12)	(13)	(14)	(15)
79,000	23,000	160,000		

VEHICLES LOADING PER WEEK DAY

BY BLOCK					TOTAL
0–5 (2.5)[1]	*5–10 (7.5)*	*10–15 (12.5)*	*15–20 (17.5)*	*20 and Over (Actual No.)*	*Vehicle-Feet*
(16)	(17)	(18)	(19)	(20)	(21)
40[2] (100)[3]	(none)	30 (375)	20 (350)	40 x 87 = 3480[4]	4,305[5]

NOTES: * A sub-identification useful for statistical analysis.
Subsequent figures shown in this table are for purposes of illustration only and do not represent an actual block in Portland.

1 The result of 5 divided by 2.
2 No. of linear feet of curb zone.
3 Is equal to (note) 1 times 2.
4 In the few instances of 20 and over the actual numbers were computed from the raw data rather than from the summary map.
5 Is equal to Columns (16), plus (17), plus (18), etc.

FIGURE 2. Work Sheet for Compilation of Data, Loading Survey and Land Use Analysis

This accounted for the information enumerated in columns (1), (3), and (4).[8] Column (2) was for the purpose of immediate reference of the block to the page and volume number of the particular Sanborn Atlas utilized.

Columns (5) to (13) were used to compile the net floor space used for a particular general use within a particular block. Previous text explains the reason for the different classifications. One important fact should be pointed out. The letters used below the classes of uses represented these uses in the subsequent statistical analysis. Columns (14) and (15) were used for the purpose of pointing out additional information needed for an understanding of floor space usage.

Columns (16) to (21) concern a term called vehicle-feet. In its simplest sense, the term is merely a multiplication of linear feet of curb-loading space and the number of vehicles visiting this zone. For example, if there were forty linear feet of curb space and ten vehicles visiting the zone per day, the calculation would be four hundred (400) vehicle-feet.

This figure would then be adjusted later in the analysis to numbers of vehicles with the ultimate objective of calculating the number of berths required.[9] One of the major reasons for using vehicle-feet rather than a simple computation of the number of vehicles visiting each block is the belief that the loading zones themselves were some significant indication of loading needs or they would not have been in existence. One definite criticism can be leveled at this type of combination analysis and that is, it should have been part of two studies:

One study showing the relationship between land use and linear feet of curb loading zones and another study showing the relationship between simple numbers of vehicles and land use. This study, unfortunately, was not possible in terms of time, budget, equipment,

[8] A further reason is that this cross checking of identification made it possible for persons with only clerical and drafting experience to be used for the compiling and computation of data with a minimum hazard of counting the same block twice. Furthermore, it was possible to allow different people to enter the procedure of compiling the data with a minimum of training.

[9] The actual calculation used for adjustment will be discussed later in the text. Also, see Figure 2 for actual technique for computation of vehicle-feet.

and staff.[10] Furthermore, the results of analysis based on this unit were apparently reasonable from any intuitive standard the Planning and Traffic staffs were able to apply.

In order to carry on the statistical analysis subsequently to be discussed, it was necessary to sort out the data in Figure 2 on cards. The cards were made out as follows:[11]

Figure 2A

Oak, Stark, Park, and Broadway

68

80

5,000 G plus 8,000 B = 150 Vehicle-Feet

(0.6990) plus (0.9031) = (2.1761)

NOTE: 5 was utilized rather than 5,000; that is the reason for 0.6990 rather than 3.6990.

The number 68 was the plat block number. The streets were boundaries of a block. The numbers 5,000G stood for 5,000 square feet of wholesale and storage with 8,000B standing for 8,000 square feet of retail and service. These produced 150 vehicle-feet of loading. The number 80 was the block identification number and was the only identification that directly tied the data in the statistical analysis to Figure 2 and ultimately to the location of the block on a map.

The cards made it possible to sort out blocks compiled in Figure 2 into groups of blocks with a similar combination of uses.

There were two important questions to be examined before the data on Figure 2 could be analyzed: Is the relationship between the uses of the land *additive* relative to the amount of loading generated? and, Is the relationship between the uses of the land *associative* relative to the amount of loading generated?

If the answer to the first question is *yes,* then it is assumed that the different uses of the land affect the generation of loading inde-

[10] It is also obvious that this unit of vehicle-feet would not have been as necessary if the question, "Whom are you going to service with your vehicle?" had been asked during the survey. It also would not have been as necessary if the data had been the product of an origin-destination study.

[11] The equation displayed on the card shows an additive relationship. In section 3 the relationship was indicated as an associative relationship. This meant the substitution of the log of 5, 8, and 150. These logs are the circled figures. All figures in square feet were generalized to thousands for ease of handling.

pendent of one another. Put in another way, it would be assumed that the fact that a particular use was within an area containing a *variety* of uses would not affect the loading experience of that particular use.

If the answer to the second question is *yes*, the converse is true. In an area containing a variety of uses, it would be assumed that each of these uses affected one another relative to the loading experience of a particular use.

The importance of these questions is obvious since it is necessary to find out how much loading generation each use of the land is responsible for. Since it is necessary to abstract out of a pattern of relationships, it is equally necessary to arrive at some idea which is the proper pattern. Unfortunately, it is not possible to get that idea empirically at least in the form of the data that was available to this study. It was possible, however, to get an idea by a statistical technique.[12]

In order to test for joint relationship as simply as possible, sixteen blocks were sorted out, each block containing only a use combination of "retail and service" and "storage and warehouse." Then as Figure 3 indicates, the staff modified the Ezekiel method cited and the resultants were two sets of linear regressions. As can be discerned, one set of lines crossed and exhibited divergence.

This set of lines was a result of data plotted on an *arithmetic scale* on the assumption that the relationship was *additive*. The divergence is a reflection of the fact that there is an associative or joint relationship working that cannot be controlled by assuming that the relationship is additive. The other set of lines while not parallel exhibited a significantly more parallel attitude than the set of lines previously discussed. These lines were a result of data plotted on a logarithmic scale, on the assumption that the relationship was associative and not additive.[13]

On the basis previously discussed, the staff concluded that it was more reasonable to proceed on the assumption that the relation-

[12] Unfortunately it is not possible to elaborate on the technique used. See *Methods of Correlation Analysis*, Mordecai Ezekiel, John Wiley & Sons, Inc., 1941, pp. 296–299. For a complete analysis of "joint functions" see Chapters 21 and 22 of this same book.

[13] Both abscissa and ordinate are on logarithmic scales.

ship was associative. This meant that the staff would plot and analyze data on logarithmic scales rather than arithmetic scales.[14]

Analysis

When first contemplating this article, it was my wish to give in detail the exact technique of how the analysis was handled. In terms of space, I find that it is impossible to do this.[15] It is hoped, however, that the little information that is given will provide the reader with the incentive to learn and use the technique cited.

The method used is called the Graphic Short-Cut Method of Multiple Correlation Applied to Curvilinear Regressions. The method is simple when compared to the mathematical version and for a comparatively small number of observations will yield results as good as the mathematical version.

Ezekiel states in his book: "In fact, the differences between the values obtained by exact solution and those obtained by the approximation method are no larger than might readily occur by chance if the mathematical analysis were repeated on a second sample of the same size, . . ."

There are, however, some modifications that possibly should be made in Ezekiel's method of graphical computation. The larger the scale used for the variables, the more exact (generally speaking) will be the graphical computation. Therefore, it is recommended that the plat handling each dependent variable be at least one inch for every 5,000 square feet of floor space.

If the desire is to use units such as vehicle-feet, the recommendation is one inch for every 200 vehicle-feet. Adjustments will be necessary if the relationship is assumed associative since the absolute

14 This meant that equations would be set up as:

$$x_1 = [\phi_2(x_2)]\ [\phi_3(x_3)]\ [\phi_4(x_4)]$$

Not as:

$$x_1 = f_2(x_2) + f_3(x_3) + f_4(x_4)$$

15 Ezekiel in his book needed twenty-seven pages to explain the procedure used. The technique is very simple if one has a little background in correlation and even this is not necessary. With a little direction, it was possible for a draftsman without a computor and without any background in statistics or mathematics but thinking logically to derive the necessary curves. Ezekiel, pp. 277–295 and pp. 479–485.

figures will have to be changed into logarithims for both the dependent and independent variables.

The analysis derived several sets of curves and one set of curves will be used here for example. The technique for the derivation of these curves the reader will have to get from Ezekiel in literature

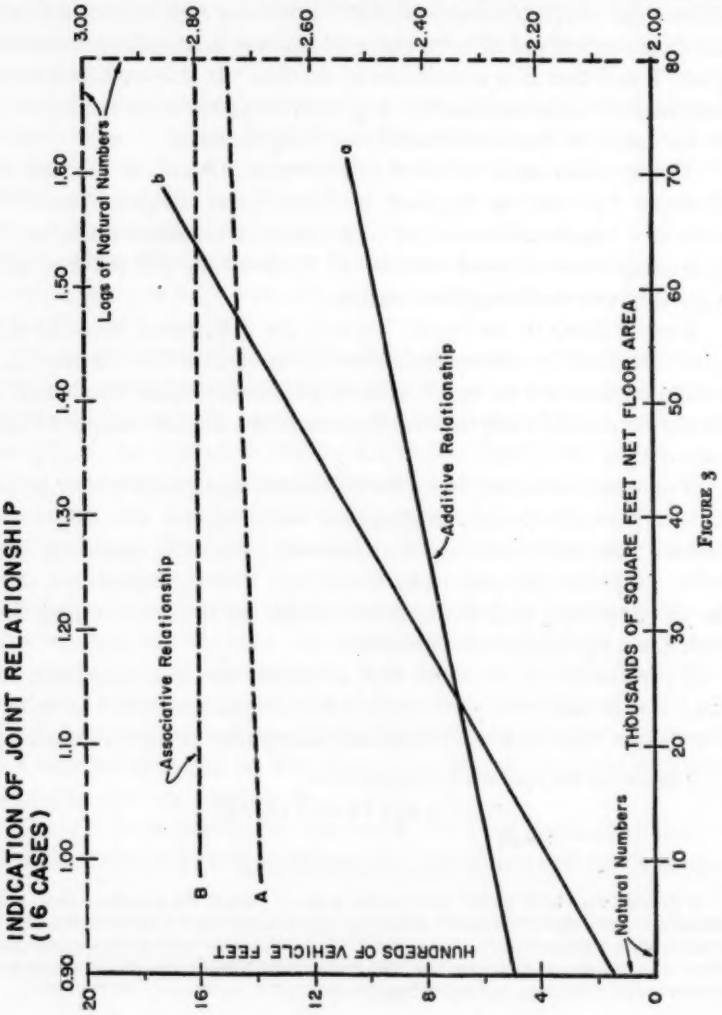


FIGURE 3

already cited. Let it suffice to state here that the independent variable will be the use of the land and the dependent variable will be vehicle-feet. The curves in this example were derived for retail and service, one of the most important classifications of land use. The curves shown in Figure 4 were derived from blocks containing more uses than retail and service. One curve, for instance, was derived from blocks each containing retail and service, office and bank, and commercial amusement.

Through the use of multiple correlation, the curvex 1 shown (regression lines) was derived from blocks with the above mixture of uses and represents *a* relationship between total floor space devoted to retail and service and vehicle-feet (loading) generated by this total floor space. The rest of the curves shown represent the same pattern of analysis.

Synthesis

As shown in Figure 4, all of the regression lines derived from the analysis (multiple correlation) were plotted on one sheet of paper. The dependent variable is still vehicle-feet and the independent variable in thousands of square feet of retail and service floor area. As can be observed, the synthesis was done in a graphical manner and the attempt was made to arrive at what might be termed an *optimum-minimum*.[16]

The question might be asked, "Why pick an optimum-minimum when the 'problem' seems mostly above such a level?" The answer to this lies in the difference between a city-wide legal requirement and a design standard fitted to an individual site. A zoning ordinance is such a city-wide legal requirement and cannot be made to fit specific site requirements except to state a minimum that will somehow ameliorate, with a degree of equity. the general ill effects generated by on-street loading relative to the city as a whole.

If the zoning ordinance raises its requirement to a level that

[16] It is to be regretted that it was impossible to give the standard error of estimate. It is further to be regretted that the line which is termed "synthesis" could not have been derived by a more precise method. Again, staff time and budget were overwhelming factors in this study. In this particular line (synthesis) eighty percent of the cases fell above it; thus it is somewhere close to the *lower limit* set by one standard error.

would "guarantee" to end all on-street loading, serious economic difficulties might result and might be all out of proportion relative

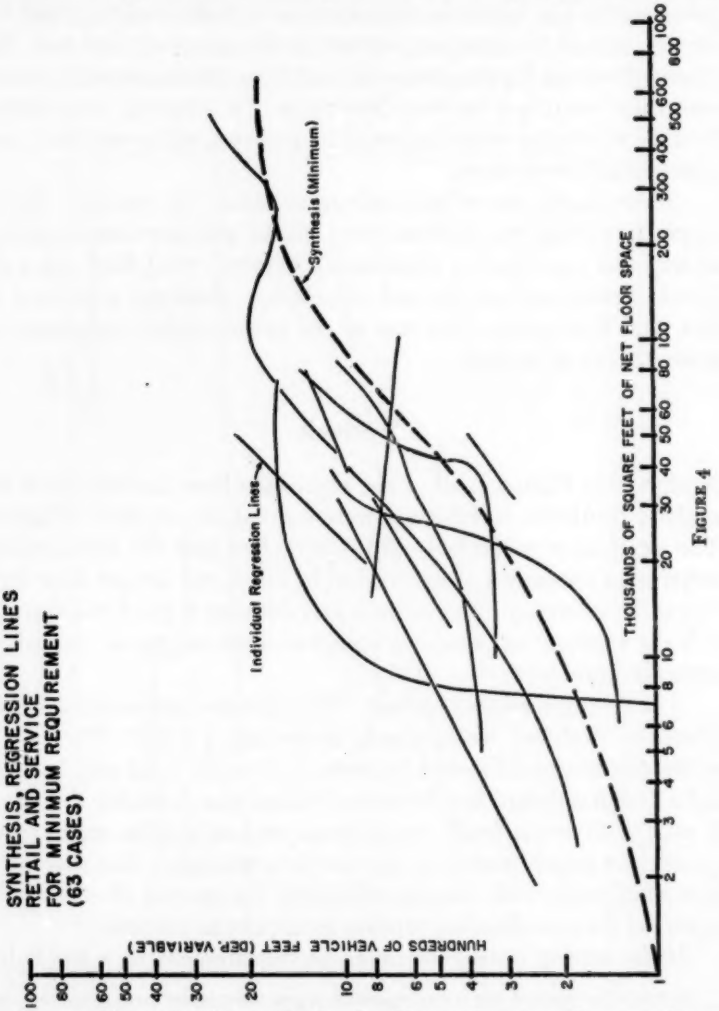

SYNTHESIS, REGRESSION LINES
RETAIL AND SERVICE
FOR MINIMUM REQUIREMENT
(63 CASES)
Individual Regression Lines
Synthesis (Minimum)
HUNDREDS OF VEHICLE FEET (DEP. VARIABLE)
100 80 60 50 40 30 20 10 8 6 5 4 3 2 1
THOUSANDS OF SQUARE FEET OF NET FLOOR SPACE
1 2 3 4 5 6 8 10 20 30 40 50 60 80 100 200 300 400 500 600 800 1000

FIGURE 4

to the settling of this particular loading grievance. It must be remembered, as must be obvious to both engineers and planners, the zoning ordinance is only one approach to the loading problem.[17]

[17] This will be discussed in conclusions.

The next step is the conversion of vehicle-feet to berths. At this point, it was assumed that the average vehicle utilized twenty linear feet of loading zone and this number was divided into the number of vehicle-feet. Therefore, if the dependent variable read 320 vehicle-feet, it was assumed that 16 vehicles visited that area in the "survey day."

Then, it was necessary to find the relationship between total vehicles per day and the number to be expected in a peak period. The figure was found by sampling the data in the loading survey and the final result was that for every 320 vehicle-feet of the dependent variable, it was felt that one (1) loading berth should be required if experience was to be the guide.

Calculating and projecting the curve described in Figure 4 with 320 vehicle-feet per loading berth as the standard, the following table was set up relative to the loading experience of retail and service.[18]

1 Berth	0 — 24,999	Net Square Footage of Floor and Ground Space.
2	25,000 — 59,999	
3	60,000 — 99,999	
4	100,000 — 159,999	
5	160,000 — 249,999	
6	250,000 — 369,999	
7	370,000 — 579,999	
8	580,000 — 899,999	
9	900,000 — 2,999,999	
10	3,000,000 — up	

Conclusions

Conclusions are general:

1. Whenever a major study or survey is to be conducted by any department of the city, a statement on the objectives and a summary of procedures to be used should be circulated to every councilman and department head. In this way, it might be possible for two or

[18] At the present time the proposed Zoning Code is being processed for presentation as a unit to the Zoning Committee of the Planning Commission. The loading requirements as part of the proposed code will reflect to a degree the figures shown in this article but will not necessarily be identical. The reason for this is that analysis of experience is only one factor in the making of a requirement. (See Appendix for further explanation.)

more departments to combine, contribute, or advise on such studies and surveys. There is an active effort within the city now to achieve this but much more work has yet to be done.

2. Before a major study or survey concerning data collection and analysis is conducted by any department of the city, a *professional statistician* should be consulted on a paid consultant basis. It is my opinion that such a consultant could easily earn his fee by showing the way toward proper and more efficient procedures for the collection and analysis of data. The city is recognizing the need for statistics by requiring in certain research positions a knowledge of statistics. This is a significant step forward but does not negate the need for professional statistical advice.

3. The zoning ordinance is only one tool for the solution of the loading problem. The major portion of the problem can only be solved by a more responsible attitude of land developers and stringent traffic control of illegal on-street loading. As the nature of the use on a particular site changes so as to increase the actual need for more off-street loading facilities but not the legal need, the responsible attitude of the site manager or owner has a major role to play. When such an attitude is absent and the manager or owner is seemingly oblivious to other more passive educational techniques, the stringent traffic control of illegal on-street loading might also have a major role to play.

4. A requirement for off-street loading facilities must be based on the use of the land. The nature of the use of the land will determine the quantity and quality of loading facilities to be required.

5. The requirement for off-street loading based on major classifications of land use should always strive for a minimum and not attempt to fit specific site needs. The needs of specific sites can only be understood as a specific design standard for the site itself.

6. Origin-Destination studies relative to commercial vehicles should always be supported by a reasonably recent land use study. The land use study should also deal in the uses of the total floor space and not only in dominant uses or first floor uses.

7. There should be a meeting of minds between planners and traffic engineers on classifications of land use that will lend themselves to a better synthesis between land use studies and traffic

studies. Conversely, there should be the same meeting of minds on some of the objectives and procedures in traffic studies and surveys.

8. Both planners and traffic engineers must set their objectives clearly in the direction of a synthesis between planning for traffic ways and planning for the use of land. Such a synthesis is known as a long range, comprehensive, general plan for the physical development of the area.

APPENDIX

In this appendix are described the experience found for four more classifications of land use. The experience should never be used directly as a requirement merely because it describes a situation. An example of this would be the class office and bank. Experience indicates for this class that an extra 5,000 square feet over 105,000 should require an additional berth. However, this may be a function of the particular use class used and, therefore, it might be more logical from the standpoint of forming a requirement to smooth out a curve that exhibits such a great change of rate. Experience should be *a* guide to the development of a requirement but never mechanically substituted for it.

Three classes that proved fruitless in terms of analysis were: public and semi-public; transportation and public utilities; and auto sales and service.

The fact that a building was a public or semi-public building did not establish a necessary relationship with loading requirements. It is probably wiser to classify such uses as private uses (i.e. office, etc.).

Transportation and public utilities probably were a bad class for the same reasons as public and semi-public. Auto sales and service was an insignificant example. These classes are still good classifications for general city planning purposes, but their use for establishing loading experience is definitely questionable.

Land Use Classification: Warehouse and Storage

Berths	Net Square Footage of Floor and Ground Space
1	0 — 36,999
2	37,000 — 699,999
3	700,000 — up

Land Use Classification: Commercial Amusement

Berths	Net Square Footage of Floor and Ground Space
1	0 — 7,999
2	8,000 — 12,999
3	13,000 — 35,999
4	36,000 — 62,999
5	63,000 — 159,999
6	160,000 — 899,999
7	900,000 — up

Land Use Classification: Office and Bank

Berths	Net Square Footage of Floor and Ground Space
1	0 — 61,999
2	62,000 — 93,999
3	94,000 — 104,999
4	105,000 — 109,999
5	110,000 — 124,999
6	125,000 — 139,999
7	140,000 — 159,999
8	160,000 — 179,999
9	180,000 — 209,999
10	210,000 — 249,999
11	250,000 — 329,999
12	330,000 — 499,999
13	500,000 — 999,999
14	1,000,000 — up

Land Use Classification: Hotel

Berths	Net Square Footage of Floor and Ground Space
1	0 — 29,999
2	30,000 — 69,999
3	70,000 — 129,999
4	130,000 — 219,999
5	220,000 — 379,999
6	380,000 — 699,999
7	700,000 — 1,499,999
8	1,500,000 — up

Speed Limits in New Mexico

ROBERT CONRADT

Mr. Conradt has been assistant director, Traffic and Safety section of the New Mexico Highway Department since October, 1952. Previously, he was a reporter for two years on the Los Angeles Daily News. He joined the New Mexico Highway Department in January, 1951 as rodman on a construction crew, was later transferred to the Traffic and Safety section and assigned for special training with the Colorado Department of Highways. He was recently awarded an Automotive Safety Foundation fellowship for the traffic engineering course at the Yale Bureau of Highway Traffic.

MOTORISTS generally ignore posted speed limits in New Mexico. The fact was brought out in recent speed zoning studies made on U.S. 85 by the New Mexico State Highway Department as part of its current program of rezoning on all state and U.S. highways. Two likely reasons for this disregard are the setting of speed limits too low and the irregular, haphazard signing of speed zones.

Local authorities responsible for setting speed limits have invariably set 20 or 25 mile-an-hour limits regardless of the nature of the area zoned. Strictness of enforcing these limits has been left to the discretion of local police. The result has been widespread disrespect among drivers for speed limits and for the police who enforce them.

Often there is confusion as to just where a speed zone begins and ends, and whether it is actually a legal zone. This is caused partly by the use of improbable speed limit signs that resemble advertising billboards, and partly by placing these signs so far in advance of the beginning of a zoned area as to make the sign appear ridiculous and unrealistic to the driver. On top of this, signs are almost never placed by municipalities to inform the motorist when he is leaving a zone area.

Sensible Speed Zoning

The way to sensible speed zoning for New Mexico was pointed out by the recent state legislature when it gave the Highway Commission

authority to establish speed limits on all state and U.S. highways,[1] including those sections within incorporated municipalities. The legislature also stated that these speed limits were to be based on engineering studies.

The Highway Department studies consist of (1) a record of physical features on and near the roadway such as curves, school crossings, side roads, business and residential areas; (2) trial runs through the area to be zoned, with observations of the speeds of other vehicles and dividing points where speeds tend to change; (3) speed checks at representative locations with an electric (radar) speed meter, and (4) study of accident reports with an on-the-spot investigation of locations where the reports point out a particular hazard. Such a study must be made at every location where a speed limit is to be established.

One of the most important considerations in determining a reasonable speed limit is the speed check. Many motorists are surprised to learn that the speeds at which people drive should be considered at all in determining a legal speed limit. They seem to think that speed limits and tax rates are imposed upon the average citizen for obscure, but somehow just, reasons. The truth is that the speeds of the drivers are the best barometer for determining safe speeds.

Most drivers are prudent, able, and have no accidents. In New Mexico in 1952, there were 328,052 licensed drivers. During the same year 13,565 vehicles were involved in accidents serious enough to be reported. This means that about 4 percent of the drivers were involved in accidents, and that 96 percent of the drivers were not involved in such accidents.

1 "Chapter 139, Section 57. ESTABLISHMENT OF STATE SPEED ZONES.—Whenever the State Highway Commission shall determine upon the basis of an engineering and traffic investigation that any prima facie speed hereinbefore set forth is greater or less than is reasonable or safe under the conditions found to exist at any intersection or other place or upon any part of a highway, said Commission may determine and declare a reasonable and safe prima facie speed limit thereat which shall be effective at all times or during hours of daylight or darkness or at such other times as may be determined when appropriate signs giving notice thereof are erected at such intersection or other place or part of the highway."

"Chapter 139, Section 58. (d) Alteration of prima facie limits on state highways or extensions thereof in a municipality by local authorities shall not be effective until such alteration has been approved by the State Highway Commission." Motor Vehicle Laws of New Mexico, 1953.

85 Percent of the Drivers Can't Be Wrong

Years of national accident experience reveal that at least 85 percent of the drivers travel at safe speeds. The 85 percentile speed is the rate at or below which this safe-driving 85 percent is traveling. Fifteen percent of the drivers will be traveling faster than the 85 percentile speed at any particular location.

Although the 85 percentile speed is considered a reasonable one, local authorities in New Mexico communities have generally posted speed limits much lower than the 85 percentile. This practice is illustrated in Figure 1 where speed limits and 85 percentile speeds are compared for some of the locations studied on U.S. 85.

The 85 percentile speed is important for considerations of enforcement. Figure 2 shows the percentage of drivers traveling faster than the posted speed limit at check points illustrated in Figure 1. It can be seen that to enforce the speed limit strictly it would be necessary to arrest more than ninety drivers out of every hundred who pass through Wagon Mount, Santa Fe, Bernalillo, Belen, Truth or Consequences, or Hatch.

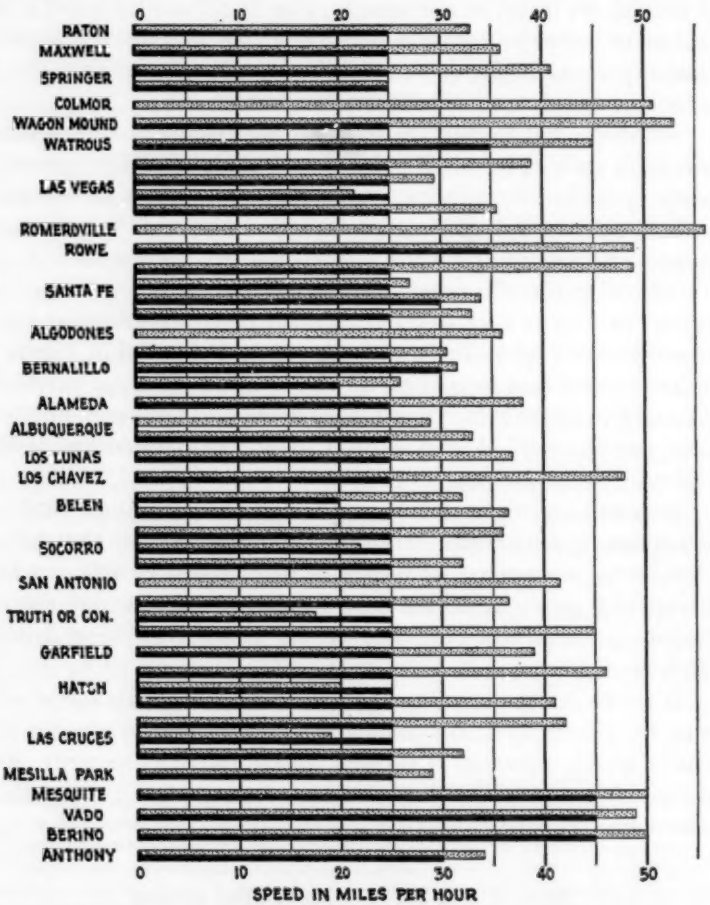
It would be impracticable and ridiculous to attempt such enforcement. Furthermore, arresting ninety percent of the drivers would serve no purpose since most of them would be safe, prudent drivers who generally do not have accidents and who were not endangering themselves or others at the speeds they were driving when arrested.

It is the driver traveling at faster than reasonable speed who must be discouraged. By placing a speed limit near the 85 percentile speed, attention is focused on the faster 15 percent. And within this group will be the drivers for whom proper and unfailing enforcement is necessary.

'Slow Them Down with Higher Limits'

The remark is often made, "If they drive 45 in a 25-mile zone, they'll drive 60 if you raise the limit to 40." Comparative speed checks show this is not true. In studies made by the Highway Department there was not a single instance where increasing the speed

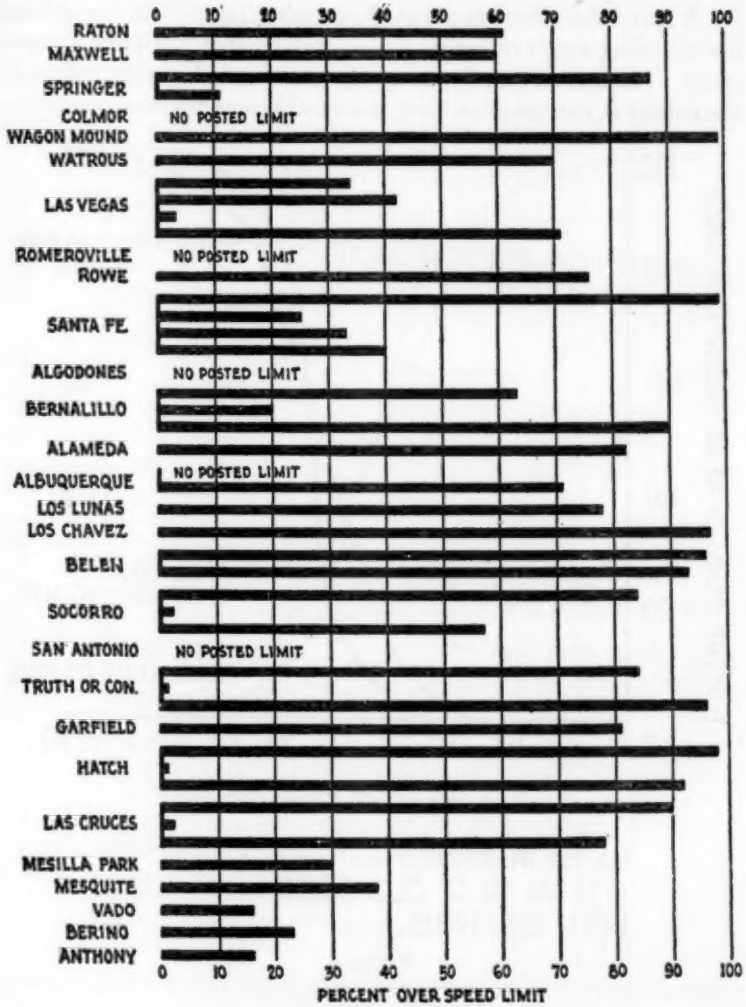
limit raised the 85 percentile speed more than two miles an hour. In fact, the 85 percentile generally drops when an unreasonably low speed limit is raised.



85 PERCENTILE SPEEDS COMPARED TO POSTED SPEED LIMITS IN NEW MEXICO COMMUNITIES ON U.S. 85

SPECKLED BAR SHOWS SPEED UP TO WHICH 85% OF DRIVERS TRAVEL.
SOLID BAR SHOWS POSTED SPEED LIMIT.

FIGURE 1



PERCENT OF DRIVERS
TRAVELING FASTER THAN THE SPEED LIMIT
IN NEW MEXICO COMMUNITIES ON U.S. 85

FIGURE 2

A speed distribution curve shows what percent of the drivers are traveling above or below any particular speed. Figure 3 shows speed distribution curves comparing two speed checks taken in Bernalillo at the same location but in different years.

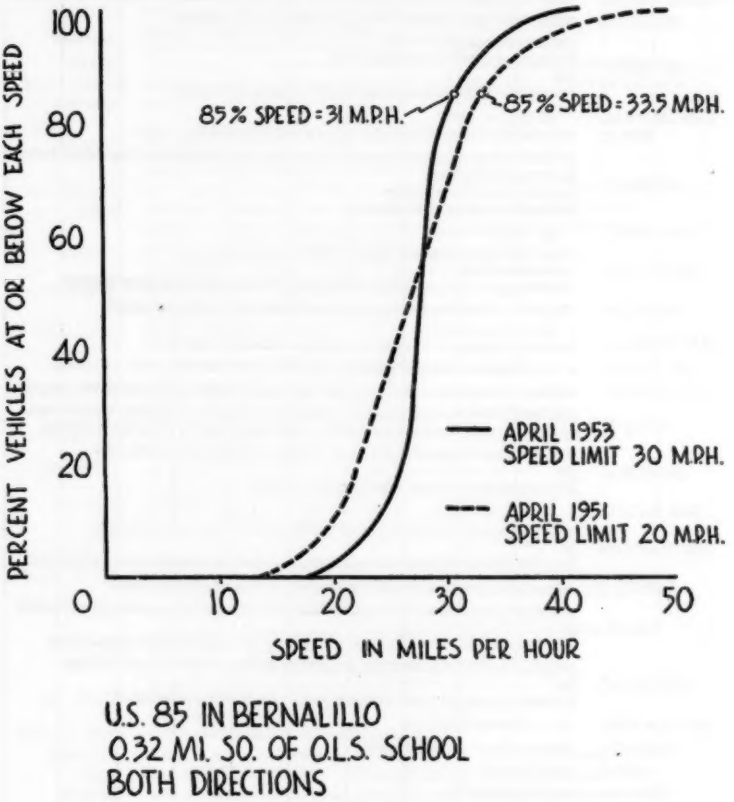


FIGURE 3

In 1951 when the speed limit was 20 miles an hour, the 85 percentile speed was 33.5, but in 1953 when the speed limit was raised to 30 miles per hour, the 85 percentile dropped to 31. Raising the speed limit 10 miles an hour lowered the 85 percentile speed 2.5 miles an hour.

Mesquite, Vado and Berino

Figures 4, 5, and 6 show cumulative speed curves for speed checks taken one year apart in Mesquite, Vado and Berino. These three

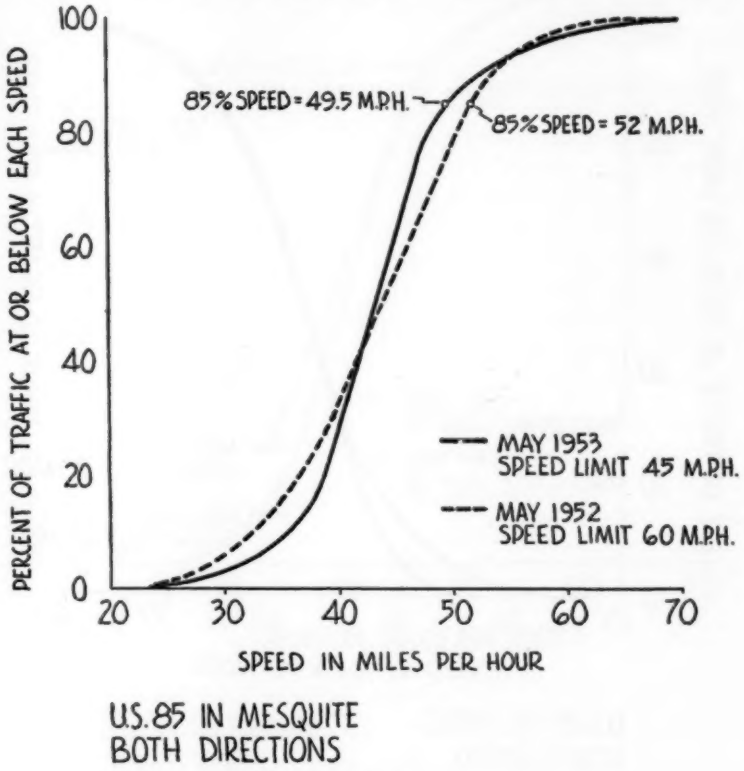


FIGURE 4

communities are very much alike. They are situated along the four-lane undivided section of U.S. 85 south of Las Cruces. The speed curves for these three communities are approximately the same, yet in 1952 the first two were zoned at 60 miles an hour and the third was zoned at 25.

In 1953 all three were posted for 45 miles an hour. When the

speed limit was raised from 25 to 45 in Berino, the 85 percentile speed changed only one-half mile an hour. In Vado where the limit was reduced from 60 to 45, the 85 percentile did not change at all. Of the three locations, the greatest change appeared in Mesquite

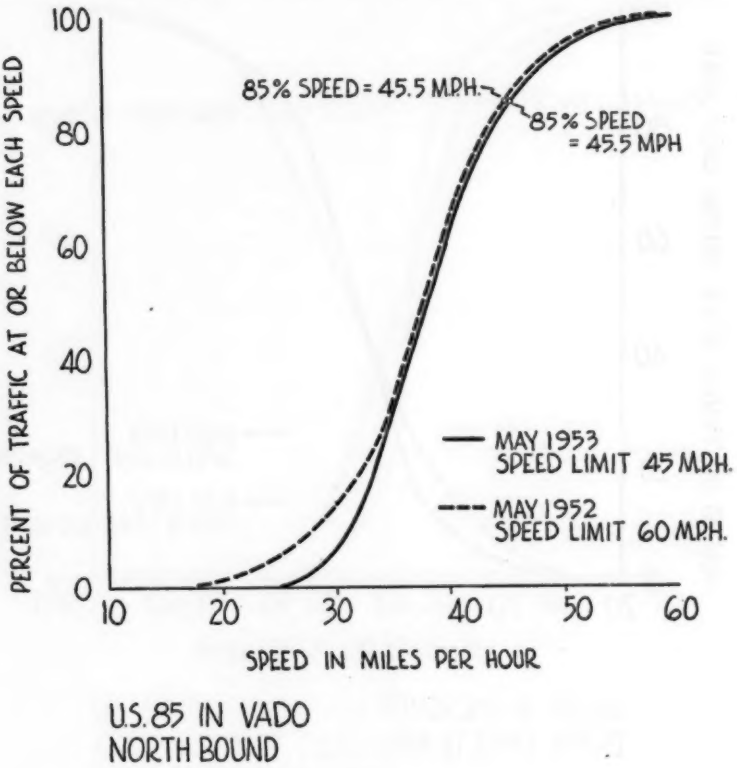


FIGURE 5

where reducing the speed limit from 60 to 45 lowered the 85 percentile 2.5 miles per hour.

The examples from Bernalillo (Figure 3) and Mesquite (Figure 4) indicate the same effect is achieved by raising a speed limit that is too low and by lowering a speed limit that is too high. Drivers apparently respond favorably to reasonable speed limits while they

will ignore a limit that is either unreasonably high or unreasonably low. Therefore, there must be an optimum speed limit which is correct for a particular location.

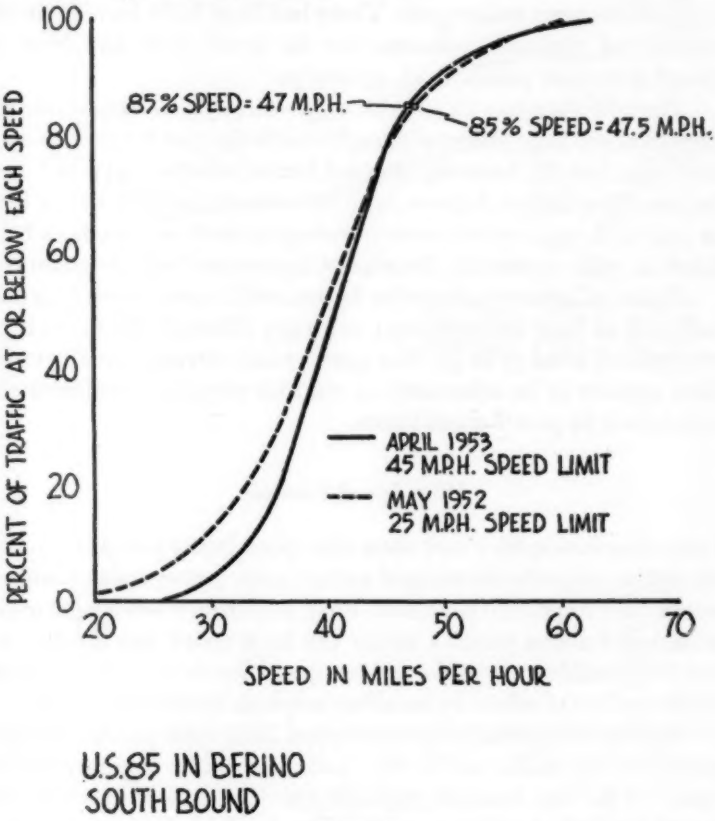


FIGURE 6

Three Santa Fe Speed Checks

Further evidence as to the effect or lack of effect of speed limits was found in comparative speed checks on U.S. 85 south of Santa Fe. Checks were taken in 1948 when there were few roadside businesses and most of the area was not speed-zoned. Checks were made again

in 1951 when a drive-in theater, a number of motor courts and other businesses had grown up beside the roadway. A speed limit of 55 miles an hour had been posted through most of the area. In 1953 checks were made again. There had been little increase in the number of roadside businesses but the speed limit had been reduced at various places to 40, 45 and 50.

Figure 7 compares the checks for the three years. Apparently the growth of roadside business brought down the speeds between 1948 and 1951, but the lowering of speed limits between 1951 and 1953 had no effect. Figure 8 shows that where the speed limit was 35 both in 1948 and 1953, drivers were traveling as much as 5 miles an hour faster in 1948, apparently because of lighter roadside development.

Figure 9, however, shows the 85 percentile speed down only one-half mile an hour between 1951 and 1953 although the speed limit was reduced from 50 to 40. The speeds which drivers actually travel then, appears to be influenced by roadside physical conditions and not entirely by posted speed limits.

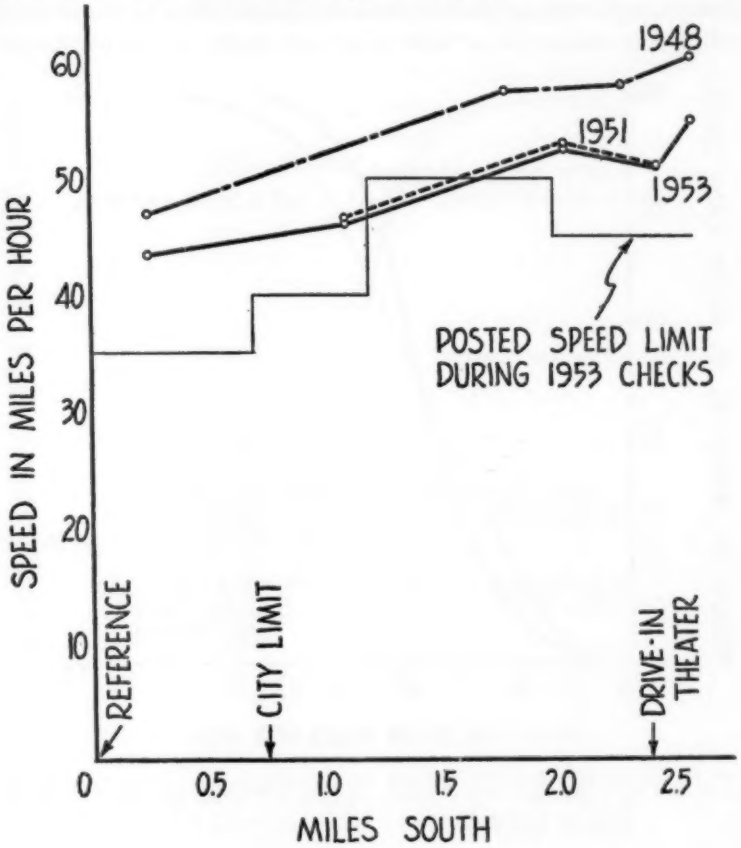
Why Speed Limits?

From these examples it may seem that speed limits have little value. Actually a properly determined and properly posted speed limit has several very important functions. First, of course, it sets a legal maximum speed above which a driver can be arrested and fined. This makes it possible to deter the reckless or careless drivers who jeopardize the welfare of others by traveling at speeds too fast for safety.

An important effect of a proper speed limit tends to bring a larger percent of the traffic within the "pace." In traffic engineering the "pace" is the one ten-mile-per-hour speed range within which the largest number of vehicles are traveling. Looking again at Figure 3 where speed curves are compared under different speed limits in Bernalillo, we see that the 1953 curve rises more abruptly than the curve for 1951, which is more gradually sloping.

In April 1951, the pace was 22 to 32 miles an hour and it included 61 percent of the vehicles. In April 1953, the pace was 24 to 34 miles an hour and included 83.5 percent of the vehicles. One of the results then of raising the speed limit from 20 to 30 miles an hour was to

bring the traffic to a more uniform speed, grouping 22.5 percent more drivers within the ten-mile-per-hour pace.



85 PERCENTILE SPEEDS
COMPARED FOR 1948, 1951 AND 1953
SOUTH BOUND
ON U.S.85 (CERRILLOS RD.) SOUTH OF SANTA FE

FIGURE 7

Closer grouping of speeds is a factor for safety. It reduces the competition between fast and slow moving vehicles. A mixture of fast and slow vehicles tends to cause the faster drivers to pass at times when they cannot do so with safety and makes it difficult for pe-

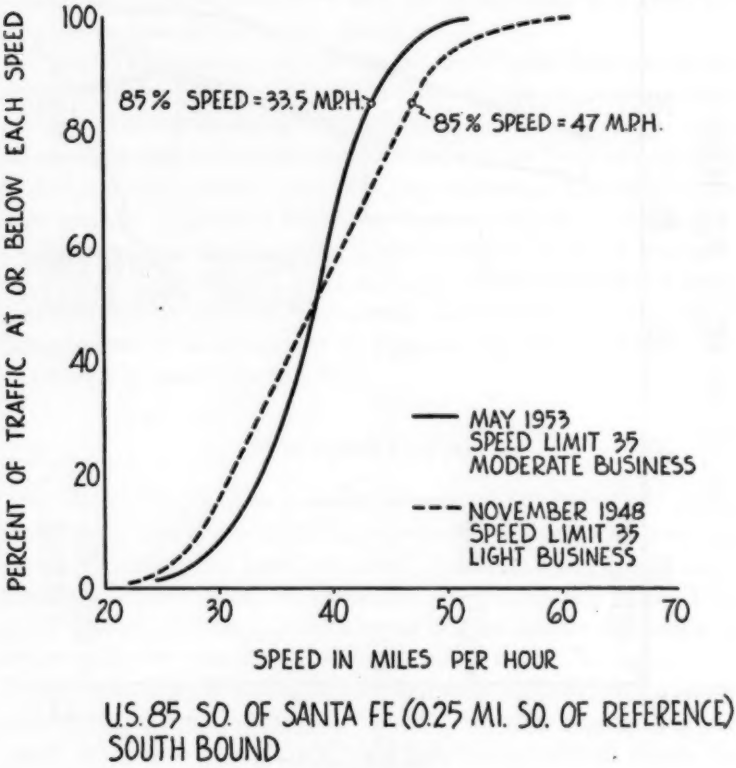


FIGURE 8

destrians and for drivers entering or leaving the stream of traffic to estimate the speeds of vehicles approaching them.

Studies by the National Safety Council have shown that in two-car collisions in which one driver was traveling at a high speed, more often than not the non-speeding driver committed a violation such as illegally taking the right-of-way. These nonspeeding viola-

tions can be attributed directly to the misjudging of the speed of the faster vehicle by the non-speeder. When speeds are nearly uniform for a stream of traffic the chances for misjudging speeds are greatly reduced.

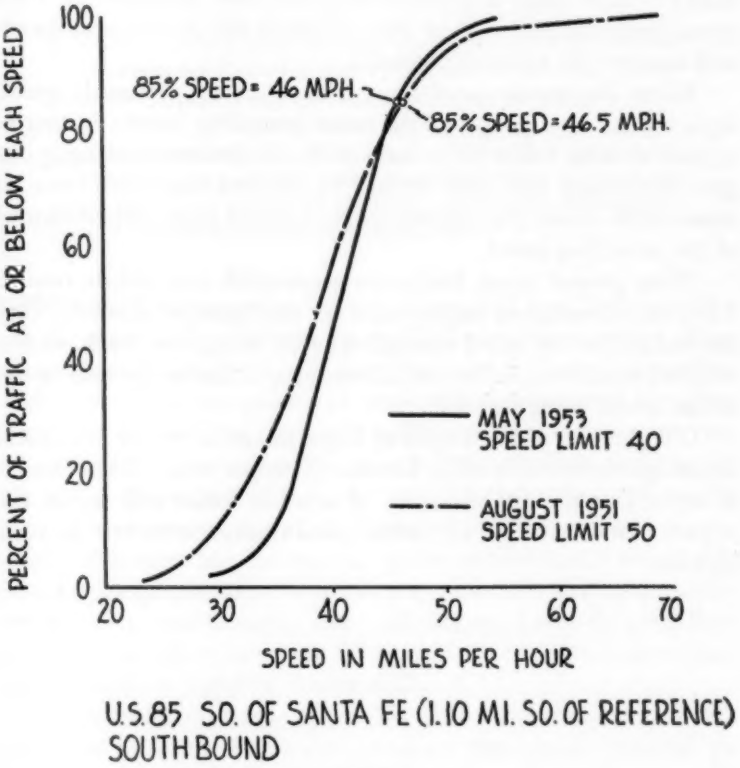


FIGURE 9

From Figure 3 it can be seen also that raising the speed limit raised the lowest speed from 13 to 17 miles an hour and lowered the top speed from 50 to 42 miles an hour. These are important changes in the speed characteristics of traffic through this area. And this is not a unique case. The same results have occurred wherever reasonable speed limits have been properly posted.

Posted speed limits should indicate to the motorist the maximum reasonable speed through the posted area. A flat 25 mile-an-hour limit through all sections of all municipalities tells the driver nothing and leaves to him the choice of a reasonable speed. This results in a wide range of speeds already described as hazardous. Thus speed limits that are too low merely spread out the range of speeds and increase the accident potential.

When the posted speed limit is near the 85 percentile speed, signs inform local people of the exact prevailing speed. Posting of 25 mile-an-hour limits where most of the drivers are traveling 45 can give pedestrians and other drivers in the area false confidence. It causes them to take chances they might not take if properly informed of the prevailing speed.

Thus, proper speed limits can accomplish worthwhile results. They can concentrate enforcement on the violators of safety; they can reduce the top speed through an area; can group traffic within a tighter speed range, and can inform people within the area of the actual speeds being traveled.

It is the aim of the Highway Department to use to the fullest advantage these worth-while benefits of proper speed limits. And it is hoped that the establishment of sensible limits will regain the respect of motorists for all posted speed limits everywhere in New Mexico.

Effective Police Traffic Training

SHELBY GALLIEN

Professor Gallien has been Director of the Public Safety Institute of Purdue University since May 1, 1953. Previously, he was a staff member of the Institute for ten years in charge of the traffic enforcement surveys and police training. He has conducted traffic enforcement surveys and prepared reports for cities in Indiana, Iowa, South Dakota, Minnesota, Illinois, Michigan, New Mexico, Wyoming, Ohio and Colorado. He lectures on traffic safety and enforcement to numerous university and municipal police training programs, and is the author of the traffic control and investigative units of the Purdue "Plant Protection Series."

TRAFFIC enforcement today is recognized as a definite police function and a primary responsibility of every police officer rather than a specialized task for a few highly trained specialists. With nationwide acceptance of traffic enforcement and the ever-increasing demands for improved traffic control it is important that we realize the magnitude of the present traffic problem and prepare our enforcement agencies to cope with it. Improvement can be secured to a varying degree through increased manpower, equipment and budget but the modern police administrator knows that personnel, equipment or finances are more effective when police officers are trained to accept responsibility and know the total limitations of the enforcement task. The training must extend from basic fundamentals to highly technical skills.

Police traffic training confronts the entire enforcement field with a gigantic problem since there are more than 40,000 separate enforcement agencies in the United States and each has its own traffic problem. The entire enforcement operation employs about 200,000 men and women with an operational cost of about one billion dollars per year. The actual cost in dollars, large as it may seem, on a national basis is relatively small when compared to our annual traffic accident loss estimated at three and three quarter billion dollars in 1952. In addition, our crime bill in the United States is estimated to range between twenty and thirty billion dollars annually.

Far more important than our monetary loss is the nation's thirty-five to forty thousand traffic fatalities and well over a million injured motorists and pedestrians every year.

From the statistical limitations alone of our present traffic enforcement problem, it is apparent that the police of the United States face a dynamic problem that will continue to expand. Traffic experts, the auto and trucking industry, and state and national government officials anticipate an even greater problem in the future. It is estimated that by 1975 the police traffic enforcement problem will involve some 75,000,000 motor vehicles.

More Police Training Needed

Progressive enforcement agencies on municipal, county and state levels are being forced to attack their traffic control problem in a more scientific manner which in turn requires skilled and trained personnel. The magnitude of the traffic problem alone has made the need for police training more apparent. One barrier to uniform and standardized police traffic training is the limited facilities and shortage of properly trained instructors. This is due in part to the newness of police training and the actual police profession in the United States. Police training is basically less than one hundred years old and cannot be compared favorably with other age-old professions of medicine, religion, law and teaching.

The first city to organize a police department was London in 1829. There was a lag of thirty years before it was deemed necessary to provide an officer training program. The first police training school was organized in London in 1859.

The English police training problem came to light years before we recognized the need in the United States. The first organized police department in the United States was in New York City in 1844, followed thirty years later by a training program when the New York Police Academy came into being as a training institution about 1875.

In a natural sequence of east-to-west movement in the United States, state enforcement agencies were established. The earliest on record was the Pennsylvania State Police in 1905. Records indicate

that the Texas Rangers were organized in 1835 and the Massachusetts State Police in 1865. It is important to note that these were not truly state enforcement units; the Texas Rangers were really border patrol and the Massachusetts enforcement group were state constables. The state enforcement agencies appeared with the advent of the automobile and soon numerous organizations were established and limited to traffic control enforcement.

With the expansion of the police training program on the municipal, state and county levels, federal agencies with enforcement powers recognized the training need and as a result the Federal Bureau of Investigation established the National Police Academy in 1936. Traffic training was included as a definite part of the curriculum.

University Police-Training Programs

During this formative period of police training when the educational program grew out of established enforcement agencies, another area offered valuable assistance to the police officer training plan. The established training centers, colleges and universities, considered the need and offered varied training courses for police officers, technicians and administrators. The first university-type police training program was started on the west coast at the University of California at Berkeley in 1916. Police training later appeared on numerous other college campuses and flourished with the financial assistance of the Smith-Hughes Act of 1917.

In this embryonic training stage, courses were offered at the University of Southern California as early as 1923 and at Northwestern and Chicago Universities in 1929. By 1926 Harvard University established a Traffic Research program. From this humble start numerous other colleges accepted the challenge. By 1936 the program was able to expand on a national scale with funds made available for vocational training by the Federal George Deen Act.

The college training plan for enforcement officers extended generally across the United States and grew most vigorously in the schools situated in the larger cities. It was apparent at this time that the various college programs began to restrict their training or

assume a characteristic pattern that was typical of the training plan offered. By 1934 the Crime Laboratory of Northwestern University changed over to traffic training completely and became known as the Northwestern University Traffic Institute. The institute specializes in training traffic officers selected on a scholarship basis from various cities and states. The enrollment grew and traffic training was made available to police officers from foreign countries. This program was established as a nine-months' course on the Northwestern campus for personnel with traffic enforcement experience rather than scholastic standards.

The Harvard Traffic Research program was quickly identified by its traffic engineering training plan. At present Harvard University is identified by its courses in legal medicine and its homicide investigation course. Traffic engineering type of training is now offered by Yale University which has established itself in the traffic training field through its contribution to the traffic engineering field, highway traffic and parking studies made at the Bureau of Highway Traffic.

Purdue University entered the police traffic training field in 1936. The Purdue program provided annual police-recruit training courses, traffic short courses and seminars, and regional traffic training programs through extension service to various cities of the state.

In 1939 New York University's Center of Safety Education offered an academic program that led to an advanced degree in safety education and closely allied fields of traffic safety. This course, open to police personnel, was designed to prepare persons capable of developing and directing municipal, school, or police traffic safety programs.

The University of Louisville offered a police training plan in 1950 designed to train police officials to better understand the minority group problem, recognize the limitations, and cope with the situation in an efficient manner. Traffic enforcement and engineering subjects are included in the training plan.

Michigan State, Washington State, Wichita, Indiana, San Jose and Southern California universities have characterized their police training program by offering a four-year plan that leads to a degree

in police science. The popularity of the program is indicated by the increased enrollment and demand for broad police training with specialization in traffic enforcement, crime, administration and laboratory techniques.

It is apparent that tremendous progress has been made in the police traffic training field in the last twenty years. World War II may have impeded certain phases of the program but an overall evaluation points up the stabilization and uniformity injected into the police field. The magnitude of the military policing operation alone did much to improve and standardize certain civilian traffic control operations. The intensive military police training plan established a need for nationwide standardization of enforcement practices and definitely stimulated a desire for police training.

Police training is already recognized as an effective tool in the enforcement field and more communities and states are aware of the need and are demanding trained police executives. The trained police administrator operates his enforcement program as a business venture and knows training is essential to secure the maximum return in enforcement service and protection. The very fact that the public is demanding trained administrators will ultimately open the door for a nationwide acceptance of the need for better trained police officers.

Police Training Emphasizes Responsibility

Traffic training must be an integral part of all police training. Every officer must be indoctrinated with the fundamentals of traffic control, investigative techniques, and be basically trained to assume any preliminary enforcement responsibility.

Specialized training should be restricted to those limited areas where advanced knowledge of a technical nature is required to perform a task satisfactorily. In all police training it is essential to stress the thought that enforcement officers are required to assume a broad responsibility rather than be considered a group of individual specialists.

With an expanding training plan comes the problem of allocating the responsibility. Should it be a responsibility of the individual

municipal police departments, state police units, federal enforcement agencies, colleges and universities or business groups? Before the responsibility can be delegated to or assumed by any one group of persons, all agencies with policing experience should review the training needs in their entirety. The police training agencies that can offer the best training program, in any given training area, the most economically, efficiently and with the best qualified instructors should be identified and delegated the responsibility.

Training requirements—whether for the traffic field or the entire enforcement field—come with professionalization. To upgrade our entire police training program we must take inventory of the available training and objectively determine our present status. We must decide after weighing the facts whether the present training progress indicates a planned advancement or reflects a minimum advancement that accrued with the growth of the police profession through trial and error. Police training must develop beyond the bare minimum needs and be guided toward a realistic professional level that an officer can acquire through formal school training, practical experience through a form of interneship, and continued in-service training conducted by qualified personnel.

To trace detailed progress in the police training field, it appears that no single agency is adequately equipped and experienced to assume the full responsibility for training all police officers. The educational needs are broad and extend into numerous recognized professional fields.

One must consider in allocating the police training responsibility that our total program today including local, state, federal and college programs still represents individual activity. The best police training programs today are spotted irregularly across the country and do not necessarily represent the collective efforts of the 200,000 men and women in the police profession but rather outstanding individual effort.

A basic characteristic of police training is revealed by the fact that the more progressive police agencies provide training for their personnel or send officers to schools outside the department for additional training, while the retarded departments generally fail to recognize the training need and to accept the training available.

In reviewing numerous individual traffic training programs, it is obvious that there are varied schools of thought. The lack of uniformity in training, methods, techniques, philosophy, attitude, and standards causes confusion among the available instructional staff which is reflected to a greater extent in the early training of recruits.

Police Training on Professional Level

To progress steadily to a realistic professional level, it is necessary to clearly identify the limits of the total police training program and solidify our basic concept of the essential information that every police officer must know to function efficiently.

We already unanimously agree that police training requirements must include a certain amount of formal training. It is important that we recognize minimum and maximum limitations in the selection of new police personnel. Personnel selection offers tremendous possibilities of being the key to professionalization. To upgrade the total police training program, it is necessary to saturate the enforcement personnel of this country with men and women who have a solid academic background and high moral standards. This accepted standard does not appear to be a barrier but there are police departments that fail to meet this bare minimum requirement under prevailing conditions today.

Police training, to be accepted on a recognized professional status, must not depend on cost-free training service. It is generally accepted in any business that service of any type must be purchased. In the police training field it is important to get the specific subject coverage and quality instruction to meet individual departmental requirements. To be able to demand specific subject matter coverage instead of a free packaged training program, enforcement agencies must be in a position to finance their training needs. It follows that to provide adequate training for any police agency it is necessary that the state or political sub-division of the state provide a fixed budget for training purposes.

Today a survey of the enforcement field would definitely indicate that the best trained police personnel and the best police training programs are found in those departments that recognize the

value of sound training and provide a budget to make the desired training available.

The training plan to meet professional standards must be adjusted to a fine degree of uniformity and yet recognize the individual differences of the 40,000 agencies. These differences are so numerous and varied that they are difficult to align in definite catagories. Various state laws created in the past and designed to aid the enforcement field can be readily classified as outstanding barriers today. Laws requiring state and city residence for employment, restricting the selection of top administrative personnel to departmental ranks, election of the chief of police, and state tax limitations on municipal police budgets, are but a few of the common barriers recognized today. Modification of these legal bonds will in some instances require long periods of time since they may involve changing the state charter.

An in-service training program offers a real opportunity to stress local enforcement and management problems. It is important, however, to be cautious and avoid inbreeding in local techniques and methods. To maintain an effective police training program, outside-the-department assistance is vital. The police training field will profit most from specialized outside training when the outside training program is geared to the capabilities of the advancing enforcement agencies.

Pre-service training for police traffic personnel is difficult to identify and limit. Until the term is defined specifically it appears that the police profession can demand very little from this possibility. However, we should collectively agree on the academic hurdle that must be placed before all new police recruits. To upgrade police training, it is essential that we hold to a minimum standard of a high school diploma, good moral character and definite physical requirements.

The very nature of police work, the diversified responsibilities, and degree of technical knowledge needed are but a few reasons why definite training standards must be adopted. Police administrators and progressive leaders from the entire enforcement field must determine the degree of training necessary. It is important to know what percentage of the total police personnel need the scientific or

administrative background available in a four-year college course. This can be ascertained only through a thorough job analysis that will ultimately determine the needs and limitations of traffic enforcement, a major police operation. When the limitations are known, specific standards can be established for training the traffic officer and the entire police profession.

Police training has proved that it is a sound investment, will insure professional law enforcement, and will point the way to new horizons in future training. The training program is most effective when it uses the resources and experiences available from numerous agencies in fields closely related to enforcement. To reach a professional standard it will be necessary to adhere to the established patterns of other professions and trust the formal training for both basic and technical knowledge to the bonafide training institutions of this country. With established training centers adequately supported, and qualified instructors to develop a planned curriculum and research into current problems, it will be possible to attract career people into the police field.

To keep abreast of advancing enforcement needs, the training plan must provide for experimentation. It must also follow uniform standards with a degree of flexibility that will not destroy the identity of the individual police department.

Pittsburgh's Parking Authority

WILLIAM R. B. FROEHLICH

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A TOP-RANKING problem in cities today is how to provide off-street parking spaces to prevent existing business districts from strangling in their own congestion. In 1947, Pittsburgh boldly created the first big city parking authority.

Pittsburgh's Authority has been the trail breaker. As a pioneer in its field, its past six years have been difficult, many obstacles encountered. Those obstacles are being gradually brushed away and a larger program is about to develop.

No attempt will be made to argue the question of authority operation versus other devices for meeting the parking problem, either public or private. That subject has been widely treated. Nor will this article attempt to evaluate the parking authority mechanism in detail. A complete booklet, entitled "Parking Authorities," has been published this year by the Eno Foundation. The primary purpose of this discussion will be to give a short case-history of the Public Parking Authority of Pittsburgh and to outline some of its experience, with the hope that knowledge of this experience will prove profitable to others.

The initial impetus for creating Pittsburgh's public parking authority resulted from a comprehensive parking study of Pittsburgh's central business district. That study was prepared in 1946 by the Pittsburgh Regional Planning Association, a non-profit citizens' planning agency. The study not only presented a complete picture of facilities and demand but also recommended that a parking authority be created.

With these data and the recommendation as a springboard, enabling legislation was passed in the Pennsylvania legislature in

May of 1947 authorizing Pittsburgh to create a public parking authority, a public body corporate and politic, governed by a five-member unpaid board to conduct the "necessary research activity, to maintain current data leading to efficient operation of off-street parking facilities, for the fulfillment of public needs in relation to parking, establishing a permanent coordinated system of parking facilities, planning, designing, locating, acquiring, holding, constructing, improving, maintaining and operating, owning, leasing, either in the capacity of lessor or lessee, land and facilities to be devoted to the parking of vehicles of any kind."

Based on this act, the public parking authority of Pittsburgh was created in August of 1947. Late that year the constitutionality of the act was successfully tested in the Pennsylvania Supreme Court. The years 1948 and 1949 were consumed by engineering studies, prepared by private consulting firms, which analyzed the financial feasibility of constructing six garages in Pittsburgh's downtown business district. The six garages originally proposed as the initial phase were later reduced to four. Land acquisition on the four sites began in 1949.

In 1950, architects were retained and plans and specifications prepared for the four garages. With the Korean war bringing control of critical materials such as steel, copper and aluminum, it was necessary for the authority to apply to the National Production Authority to obtain necessary materials. The N. P. A. approved only two of the four garages. In the summer of 1951, bids for the two were publicly advertised, the contract was awarded, and on October 1, 1951, a six million dollar revenue bond issue was floated by the Authority. Construction began in the middle of October and after much difficulty with materials priority, building trades strikes and the steel strike, the first two Authority garages were completed in October and November 1952.

Operation of Two Garages

Both garages constructed by the parking authority are open-deck, reinforced concrete ramp-type. The designs were studied so that each garage could be operated with customers parking their own

cars if labor costs increased to such a point that reduction of overhead would be required. Fewer than five percent of the marked stalls are blocked. This necessitates moving another car before the car in the blocked stall can be moved. Garage circulation is simple and double ramps in each garage are wide and of easy gradient, making it possible for drivers unfamiliar with garage driving to negotiate the ramps without difficulty. The number of spaces in each garage, by category, is shown in table I below.

Table I

PARKING SPACES—GARAGES ONE AND TWO

	Marked Stalls	*Aisle Spaces*	*Reservoir Area*	*Total Spaces*
Garage One	580	148	58	786
Garage Two	634	103	88	825

Garage One, with seven parking levels with one side fronting on a commercial street, has five store room spaces at street level. The structure has garage entrances from two streets, each street giving access to a different parking level. Garage Two has six parking levels with entrances from two one-way streets. Both garages have ample waiting room spaces, public toilet facilities, passenger elevators for the use of monthly parkers, and man-lifts for quick vertical transportation of parking attendants.

Construction costs of the garages, exclusive of store spaces, not including reservoir space, amounted to $1,970 a car space, or $5.50 a square foot. These construction costs are somewhat high for several reasons. First, it was necessary to reinforce a railroad tunnel that cut diagonally under one of the properties. Second, garages were advertised and contracts let during a period of uncertainty in construction, caused by the controlled materials program that made many contractors reluctant to bid because materials might not be available after construction was under way. Finally, the authority was anxious to construct garages that would be a credit to the downtown district. Therefore, no effort was spared, within reason, to make the structures attractive and well equipped with conveniences for the using public.

The public parking authority has retained a consulting engineer

Garage One, Public Parking Authority of Pittsburgh, at Bigelow Boulevard and Sixth Avenue. Bigelow Boulevard entrance has five reservoir lanes. Note four of five storeroom areas along Sixth Avenue.

Garage Two, Public Parking Authority of Pittsburgh. Circular ramps at near end are hidden by precast concrete panels.

to study the Pittsburgh building code as it affects parking garage construction, with the expectation of recommending changes to permit less expensive construction guaranteeing engineeringly-sound structures.

Lease Governing Operation

After much study and consideration the parking authority decided in 1951 not to operate the first two garages directly but to lease their operation under a carefully controlled lease. After inquiry to determine interest of several firms, the authority negotiated a lease with a well-established parking operator of long experience, who incorporated a new firm called Parking Service Corporation.

One lease covers the operation of both garages. Actually the lease is a form of management contract in which the parking authority receives certain guarantees from the lessee. Main provisions of the six-year lease follow: 1. A guaranteed annual rental from the lessee sufficient to pay annual amortization charges on the bond issue. 2. A distribution of net profit between the authority and the lessee in which the authority will receive 60 percent of the first $50,000 profit, 75 percent of the next $50,000, and 85 percent over $100,000. 3. A deposit by the lessee of one year's rent to guarantee faithful performance. 4. Control by the authority of all parking rates charged at the garages. 5. Operation by the lessee subject to the rules and regulations adopted by the authority. From the above listing it can readily be seen that the parking authority exercises good control over the operation, in addition to receiving financial guarantees.

During the initial seven-month period, operation under the lease has been highly satisfactory, with the lessee and the authority working out mutual problems in cooperative spirit.

Present Business and Operation

As normal in the early stages of operation of any parking garage, even where parking demand is shown to be high, the operation, beginning slowly, continually and gradually increased throughout the first months. At present, the use of the garages is still increasing, with the combined operation past the financial break-even point

since the end of March, fewer than six months after the beginning of operation. Daily turnover of total spaces ranges from 1.6 to 2.1.

Parking demand studies of areas surrounding the two garages showed a greater need for short-time parking than long time. Therefore, the rates were tailored to appeal primarily to the short-time parker, (the shopper, salesman, and business man). Transient rates at each garage are as follows: $.25 for ½ hour or less, $.35 for one hour or less, $.50 for two hours or less, $.65 for three hours or less, $.80 for four hours or less, $1 for five hours or less, $1.10 for six hours or less, $1.20 for seven through nine hours, and 20 cents each additional hour to a maximum of $2 a day.

A limited number of monthly stalls are available at each garage at $25 a month without in-and-out privileges and $30 a month with in-and-out privileges. The authority has already reduced rates for persons parking longer than five hours, because in studying the breakdown of hourly parking under the original rate it was discovered that the percentage of short-time parkers was higher than demand studies showed to be existing in the area, an indication that too many long-time parkers were being discouraged by the higher rate.

Generally the rates charged at the two garages have been satisfactory to the public. However, there has been some criticism from a few people. These persons, knowing that the parking authority is a public body, believed that the authority should make only token charges for parking, not realizing that the authority, like every other business, must pay off its debt incurred in constructing the garages. Most of these critics have been satisfied; some can never be convinced.

The most recent study of the breakdown, by the number of hours parked, of persons using the authority garages show that 9 percent park for one-half hour or less, 22 percent for one hour or less, 43 percent for two hours or less, 57 percent for three hours or less and 72 percent for five hours or less. This indicates that the garages are used by the short-term parker, the parker who for many years in the past congested the downtown area by cruising around its narrow streets to find parking lots that were not filled. The half-hour rate is popular because many people find it possible to conduct their bank-

ing or to complete an appointment so that they can take advantage of the inexpensive cost.

Future Facilities

Continuation of the authority's parking program has been impeded by legal questions. Now the only remaining legal problem is that of tax exemption which finally should be decided in 1953. With the authority's winning the first round of the tax issue in Common Pleas Court, work is being advanced on plans and surveys for embarking on an enlarged program of construction of additional off-street facilities.

Underground Garage and Surface Park

One of the six proposed sites recommended to the authority in 1948 was the central downtown block now called Mellon Square. The original proposal called for an open deck garage. With the construction of two large skyscrapers on either side of the block, however, it was recognized that an underground garage surmounted by a surface park not only would provide parking for the increased demand in the area, but also would give open space sorely needed. In 1951 a gift of four million dollars was presented to Pittsburgh by three local foundations for the purpose of acquiring property in the block and constructing a park on the surface.

In 1952, the Public Parking Authority entered into an agreement in which Mellon Square Garage, Inc., a Pennsylvania corporation, would design, construct, and operate the parking garage for thirty-eight years. Pittsburgh has leased the subsurface rights to the Parking Authority and the authority in turn has subleased the area to Mellon Square Garage, Inc. Mellon Square at its own expense has designed a garage and surface park for approval by the authority and the city.

The garage corporation will construct the underground garage at its own expense and will build the park with funds remaining from the original gift. Upon completion of the garage, title to the structure will be invested in the Parking Authority and the garage corporation will operate the garage under a leasehold for a period

of thirty-eight years. Financing is handled entirely by Mellon Square Garage, Inc. After the beginning of operation, the Parking Authority will receive an annual rental based on percentage of gross income. In the lease agreement, requirements for the parking facilities are listed, the purposes for which the facility is to be used is outlined, and maximum allowable rates for the facility are established. At the end of the term of the lease the operation of the garage will be turned over to the Parking Authority.

The underground garage will provide 890 parking spaces on six levels. There will be direct access to the first three levels from two of the four surrounding streets. Since the elevation of one of the bounding streets is thirteen feet higher than its parallel counterpart, the grade of the park surface will be at the elevation of the higher street with cascades of water and steps leading down to the lower street.

Since Smithfield Street, the lower street, has excellent commercial frontage, space for retail stores will be constructed on two-thirds of that frontage. Garage entrances and exits will be to and from the parallel-sloped side streets. One feature of the combined park and garage design is that pedestrian sidewalks will be carried in the park above garage entrances and exits, thereby eliminating pedestrian and vehicular interference. Demolition of existing structures in the block was completed in July; excavation began in August. Construction time is estimated at eighteen months.

The Mellon Square Garage project will be financed entirely by private capital, with a long-term leasehold as security. Generally underground garages are not financially feasible when land cost and construction cost must be amortized. In this particular site the gift of land made the underground construction possible, in spite of its high cost.

Additional Downtown Garages

The authority has working drawings completed for the two downtown garages which were not approved for construction by the National Production Authority. Construction could not be started on these two structures after critical materials were decontrolled because of court suits which were underway at the time. With the end

of litigation in sight the authority is now making definite plans for financing the two. Both plans call for open deck reinforced concrete structures. The garage at Site C will have 475 parking spaces and three storerooms and the garage at Site Y will have 680 parking spaces.

In the lower end of the Golden Triangle fifty-eight acres of land is in process of complete redevelopment, thirty-six acres in park area and twenty-two contiguous acres in park-like commercial redevelopment. The Parking Authority is negotiating with a commercial redeveloper, pointing toward construction of a garage to accommodate in excess of 900 automobiles. Construction of a new hotel and additional retail space in this redevelopment area will make a parking garage a necessity.

On the eastern edge of the downtown district is 110 acres of slum that will be completely redeveloped and a large cultural center created. The area will accommodate a Civic Light Opera Amphitheater, an Opera House, a Symphony Hall and several elevator apartments. It is estimated that 3000 parking spaces will be needed to accommodate persons attending the cultural activities. These spaces are close enough to the business district that they can be used for all day parking during the day. The Parking Authority has been working with the Urban Redevelopment Authority on preliminary plans for this area, with the expectation that the Parking Authority will handle parking operations.

Parking Studies for Secondary Districts

Until now the effort of the Parking Authority has been concentrated on the downtown business district of Pittsburgh. This year the Authority decided to investigate parking demand in Pittsburgh's secondary business districts where parking need is also acute.

In May parking surveys were made in the North Side and East Liberty districts. These studies will be evaluated by fall so that the Authority will know what off-street facilities may be financed in those areas. From present information on land values and estimates of parking demand, it is anticipated the study will show that lots rather than garages will provide the best answers.

Legal Problems

Because it has been a pioneer in its field, Pittsburgh's Parking Authority has encountered several legal problems and has been setting much of the precedent in Parking Authority Law.

Since the Parking Authority Law was new legislation, the Authority decided that it should be tested in the Courts. In 1948, a friendly suit, *McSorley vs. Fitzgerald,* 359 Pa. 264 (1948), was argued in the Pennsylvania Supreme Court. The constitutionality of the law was upheld, and the way was clear legally for the Authority to begin operations.

The second case in which the Parking Authority was involved concerned the method of public bidding in Authority construction contracts. A Pennsylvania statute declares that all public building construction must have separate bids entered for mechanical contract phases of the work such as electrical work, heating and ventilating, and plumbing. The Authority contended that construction of its garages should not be governed by the statute since money used for construction would not be public funds, but funds of private investors. However, the Supreme Court ruled that, for the purpose of construction, the buildings were public buildings and the Authority must separately advertise its construction contracts; *Pittsburgh Public Parking Authority Petition,* 366 Pa. 10 (1950).

Gasoline Sale and Automobile Servicing

In its initial program the authority included *space* in its two garages for selling oil and gasoline and for servicing and washing of automobiles. The authority law has a specific prohibition forbidding the authority itself from engaging in the sale of oil and gasoline and servicing. Since the right to operate was to be leased to a private citizen, the authority was advised that its lessee could legitimately sell gasoline and perform services.

This was challenged in the courts, and the state supreme court upheld the decision of the lower court in enjoining the parking authority and its lessee from engaging in the sale of gasoline and oil and the performing of services, *Midtown Motors, Inc. vs. Public*

Parking Authority 372 Pa. 468 (1952). The authority's only other avenue of relief is through amendment of the parking authority law in the state legislature.

Long-Term Lease Test Case

As previously stated, the Mellon Square Underground Garage will be designed, constructed and operated by a private corporation. The basis of this arrangement is a long-term lease by which the authority leases the sub-surface of the Mellon Square Block for a period of thirty-eight years, controls the parking rates and receives a percentage of gross receipts. To test the legality of this type of arrangement, a suit was entered in which the right of the authority was challenged, first, to negotiate with a single corporation; second, to enter into a long-term lease agreement, and third, to consent not to reduce during the period of the lease an agreed-upon minimum parking rate.

The Pennsylvania Supreme Court upheld the authority on these counts. A majority opinion noted that the competitive bidding feature of the lease pertained only to construction, reconstruction, or repairs exceeding $500. The opinion stipulated in part "nowhere is it stated that there must be competitive bidding for the privilege of becoming a sub-tenant. In the absence of such a provision the authority's right to privately negotiate would be unquestioned. Indeed such practice would appear to be essential. The authority has a fundamental interest in the integrity and ability of its sub-tenant. The possibility of enhanced financial return from a subtenant engaged in such a purely non-profit public enterprise, because of a higher bid, would appear to be relatively inconsequential." *Clark vs. Public Parking Authority of Pittsburgh,* 372 Pa. 481 (1952).

Exemption from Taxation Case

The County of Allegheny has challenged the Parking Authority's right to exemption of its property and buildings from real estate taxes in spite of a specific statement in the law, "that such authorities shall not be required to pay any taxes or assessments upon any prop-

erty acquired or used by them for such (public parking) purposes."

The county denies that the garages are used for a public purpose saying that: 1) the parking facilities are operated by a lessee for profit, with a percentage of the profit going to the parking authority; and, 2) part of the first floor of one garage is leased to private parties for commercial uses other than the provision of parking facilities. The county also claims that the parking authority law violates the constitution of Pennsylvania insofar as it confers tax exemption upon public property not used for a public purpose.

The Allegheny County Court of Common Pleas ruled that the parking authority's facilities, under the present lease, are being used for a public purpose and therefore the land and buildings are exempt from taxation. The court stated that the portion of Garage One that is used as commercial storerooms is not exempted from taxation.[1]

Methods of Financing

Two methods have been used for financing parking facilities, and a third is contemplated. The first two garages were financed by a negotiated revenue bond issue to be paid from garage earnings. The issue totaled six million dollars, with 30-year 3½ percent bonds redeemable at the option of the authority. Table II shows the debt service charges and general coverage ratio.

Table II

Debt Service Charges and Coverage Ratio

Estimates for Year Ending October 1, 1953 and Thereafter

Parking Meter Revenues (66⅔% of $226,940)	$151,300
Lease Rental	332,700
Residual Balance of earnings (60% of $43,300)	25,900
Total Revenues	$509,900
Proportion of Authority expenses	20,000
Total Available for Debt Service	$489,900
Annual Interest and Amortization Charges	$332,700
Times Earned	1.48

[1] Exceptions were taken to this decision and a court *en banc* was scheduled to review the case as this article was going to press. If the decision stands, the parking authority will not be

Through an agreement with the City of Pittsburgh, the authority is authorized to borrow the revenue from certain assigned city parking meters, repayable at the city's general obligation bond rate. To get a debt service ratio of approximately 1.5, as required by investment houses, it was necessary for the authority to pledge two-thirds of the estimated parking meter revenues. The bonds were sold within one day after they were advertised. They do not constitute an obligation of the City of Pittsburgh or the Commonwealth of Pennsylvania, and neither the credit nor the taxing power of the City or Commonwealth is pledged to the payment of any part of the principal or interest.

The financing of the Mellon Square underground garage was differently handled. The City has leased subsurface rights of the public park to the parking authority; in turn the parking authority has subleased the subsurface to Mellon Square Garage, Inc. Under terms of the sublease, Mellon Square Garage will design a garage for the authority's approval, will construct it at its own expense, and will operate the garage under a lease for a period sufficient to amortize its investment. Financing has been arranged entirely by Mellon Square Garage, Inc., with no authority money involved. The parking authority will receive a rental from the garage during the term of the lease based on a perecentage of gross receipts.

A third method of financing, now under investigation, may be used for parking facilities in secondary business districts. Briefly, the parking authority would acquire the parking site by purchase or eminent domain. The authority would then lease the property to the city, which in turn would employ the authority to manage the facility. The city's liability under the lease would enable the authority to obtain the benefit of lower interest rates. Such a method would apply in areas where demand studies show that financing would be impossible on anticipated income from the parking facilities with only the parking authority's credit behind the bond issue. Admittedly, with the city's security involved, a better interest rate could be realized.

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required to pay real estate taxes on its properties and structures used for parking under lessee operation but will be required to pay taxes on any first floor storerooms in its parking garages. —The author.

An Appraisal

The authority believes its function is to supplement private lots and garages. The board agrees that its task is to *add* parking spaces where there is demand and not to take over existing facilities. The attitude is that the authority facilities should not be operated directly by the authority staff, but should be managed by experienced private operators under a lease agreement or a management contract, based on the argument that experienced private management will give better efficiency in the long run. With such a policy the authority staff will remain a small cohesive working group charged with the responsibility of supervising authority garage operations, making planning studies for additional facilities, and working out plans, specifications, financial details and other arrangements for specific projects.

From the preceding article, one can see that the first years of the parking Authority have been fraught with problems. Lacking precedent, the authority has driven forward resolutely and boldly. Though the first phase has been slowed on occasion by obstacles in the form of law suits and financial difficulties, progress was never stopped. With two garages completed, one beginning the excavation stage, and three more on the architects' boards, the authority is about to embark on its second-phase program.

But newly-proud Pittsburghers like to point out that this entire parking authority activity is merely one facet of the gem that is gradually being cut from old Pittsburgh through its remarkable program of redevelopment.

Education for Engineering and Our Transportation Problems

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THE relatively recent development of modern transportation problems and the subsequent growth of courses in traffic and transportation engineering have each reached a point where they might be considered to be in a "fluid state." In each case engineers and educators have found themselves trying to catch up with the problem only to find that their efforts, at best, are only keeping the problem within bounds.

In some instances the transportation problems are developing faster than the ability to cope with them. For these reasons, this article attempts to set forth certain engineering philosophies and educational concepts considered fundamental to any concerted attack on our present-day and future transportation problems.

As an aid to understanding the transportation problem, it might be appropriate to review briefly several stages of transportation development in this country. From the beginning of this century to the First World War, transportation engineering activities were concerned primarily with the construction and operation of railroads. Secondary problems included urban mass transportation and a moderate amount of road construction.

Similarly, engineering education in this era was concerned with the economics of railroad location, curves and earthwork, and similar

railroad operating problems. Major emphasis in both engineering and education was in the economics of construction and operation. Only scant attention was given to the effect of the railroad networks upon the development of cities, industries, and the country in general.

Shortly after the end of the First World War, railroad problems were mainly operational. Major civil engineering emphasis was placed upon the location and construction of highways and streets to meet the needs of the automobile. Little stress went to secondary problems in urban transportation, water and air transportation. In this era, engineering design concerned itself with the structural characteristics of pavements and bridges with only minor thought to geometric design. In the same manner, engineering education began research and development in the theory of pavement design.

When the first major highway networks had been completed in the twenties and thirties, engineers began to realize that developments in the automobile industry were outmoding the highways before they had had significant use. Thus, in the period before the Second World War we began to give engineering emphasis to the geometrical considerations of the highway.

Safety Built into the Highway

After World War II, state and federal agencies began to build safety into the highway from a geometrical standpoint only to find that as they did this, many of their networks became outmoded on the basis of traffic capacity. The tremendous increases in private and commercial highway transportation had not been anticipated. Whether the argument that no one could have foreseen this automotive age is valid is a moot point. Along with the rising accident rate and congestion on our major highways urban traffic problems became of great magnitude. Thus was the embryonic development—both in engineering and educationally—of the traffic engineer whose job it was to get traffic moving on existing streets and highways. Developments in traffic operations and traffic controls in the last decade have been significant and far reaching. Similar highway problems in this era attempted to cope with continually increasing truck weights

upon the highways. During this period railroad transportation problems were mainly operational and financial, and airport design considerations became significantly important because of continually changing aeroplane design.

In the last few years, it would appear that transportation in this country has reached yet another stage in its development. Many of our commercial transportation facilities such as railroads and urban mass transit are facing major financial plights. In many cases they are hampered by archaic rules and regulations. Our highways are still inadequate structurally, inadequate geometrically, and in the majority of cases crowded to capacity.

The financial burden of new highways has led to the development of toll highways. Many of our newer limited access developments are costing several millions of dollars a mile. Parking facilities are inadequate and often we find our new highways and storage areas outmoded soon after they are constructed. Our modern highways have led to the development of major decentralized areas. They have been either the cause or effect of industrial decentralization. They have caused a revised concept of living and movement of equal significance to that caused by the joining of this country by the railroads. Modern transportation of today and of the future will continue to increase in cost as greater and greater mobility and flexibility parallels new concepts in living.

It would appear therefore that today's engineers and educators have arrived at an era of transportation planning and integration. Traffic operations and the fundamental concepts of design no longer will suffice to solve modern transportation problems. Mere construction of bigger and newer toll roads will not answer the problems of the future. It remains then to pose the question of whether transportation engineers and educators should take the leadership in attempting to find answers to our basic planning and integration problems or whether they should confine their efforts to transportation design and operation. It is the opinion of this writer that the *professional engineer* must take major responsibility for planning and directing engineering works that will be for the benefit, convenience, safety, and economics of mankind. If he is to accomplish this end, he must give serious thought to plans for the future.

Problem Called a "General Transportation Problem"

Specifically what is meant by this era of planning and integration? Fundamentally, we do not have a traffic problem, or a parking problem, or a mass transportation problem, or a highway problem. We are faced with a general transportation problem. One of the basic reasons for the problem is that each form of transportation has developed and is operating with little realization that all transportation types serve similar purposes.

Needless duplication of facilities, excessive competition, unfair regulations, subsidies, and the unwillingness of many groups to admit the coexistent nature of all types of transportation do not lead to an efficient transportation system. Is it then the responsibility of the transportation engineer to take the leadership in integrating transportation? How are we to meet the financial problems of modern highway transportation? Do our traditionally accepted types of use-tax and tolls answer the needs of modern transportation? Is the major justification for a highway the fact that financial estimates indicate that people will pay enough tolls to cover the cost of the project?

What is the effect of a new highway upon community living, business and industrial decentralization? How will future changes in living patterns affect our transportation operations? What do business and industry require of transportation? How are urban transportation problems to be alleviated? In fact just what is the desirable level of efficiency for transportation in our economy?

It is axiomatic that there is no solution to the problem; rather a balance is to be maintained between transportation operations and other activities, both social and economic. Answers are not forthcoming to all these questions. Answers, however, must be found. What, then, is the responsibility of the transportation engineer in providing these answers? Finite answers require study in many fields including engineering, economics, finance, regional planning, and sociology to mention a few. Apparently, if answers are to be found, the transportation engineer must go further than the design and operation of a facility. His responsibility for planning and design of engineering works requires that he attempt to get to the heart of

the transportation problem rather than confine his efforts merely to designing a highway to be constructed between A and B.

Although this writer would not presume to pass judgment on the activities of transportation engineering in the last half century, certain general conclusions might be indicated. From the engineering point of view, and particularly from the educational point of view, excessive effort has been made to cope with transportation problems after they have arrived, with only minor thought being given to probable future problems. A geometrical attack on the highway problem followed the need for such an attack. Little thought was given to transportation operational problems until their magnitude required activity in this area.

Efforts Again Are Current

Today our efforts again are mainly to build highways that will suit today's operational and capacity problems. In all probability the major fault has not been from the engineering appraisal only, but from the inability of administrators and political bodies to understand the magnitude of their transportation problems. To state that engineers and educators have shirked their responsibility in not crusading for a planned approach to transportation would be unfair; however, this article would not be unique in noting that many times engineers and educators have been not unproud of their "ivory tower" existence.

Specifically what problem does education face in this area? First of all, engineering education must lead in developing new and better attacks on the problem. It must pioneer the approach to intelligent transportation planning. If its activity is mainly to train students only in tried and true approaches to yesterday's and today's problems it has not fulfilled its mission. The educational atmosphere is designed for research into the overall transportation problem. The university may call upon many disciplines that have a bearing upon the problem.

While it should and must help to perfect highway design and operation problems as well as other transportation techniques it must never do this at the expense of acquainting its students with

the true nature of the problem and with the limitations of present-day understanding of the problem.

Illustrating what is believed to be the general type of approach to the training of transportation engineers certain philosophies are presented as follows:

1. Any training in transportation engineering must give ample emphasis to Transportation Planning and Intergration. If necessary certain of the detailed skills must be minimized. Future transportation engineers who do not have an understanding of the need and the approach to transportation planning and intergration cannot provide the required leadership nor can they comprehend the relationship of transportation planning and design to the correlated fields of regional planning, finance, sociology, etc.

2. Any training in transportation engineering *must* cover the basic features of all transportation. The specialist in highway design, or traffic operations, or urban thoroughfare design must understand the scope and interrelationship of all transportation facilities and operations if he or she is to be an effective specialist in any area or division of transportation engineering.

3. The magnitude and complexity of the transportation problem indicates that major emphasis in this type of education should be found at the post graduate level. This educational approach might be considered similar to that of city planning.

4. It is desirable that students in this area have an engineering background. A civil engineering background is desirable although pre-transportation training can be given to engineering and science students not having work in *civil* engineering.

5. While the engineering background is significant, it is important that the student have a broad background also in the humanities and social science. Transportation engineering has more social, planning, and economic values than other types of engineering. It deals directly with the habits of people as well as with strictly physical and natural forces of nature.

So that we may be specific by illustrating an educational approach to the training of transportation engineers the following general thoughts on subjects and courses are developed in abbreviated form.

Transportation Engineering Curriculum
(Graduate School)

Required Subjects: In keeping with the concepts of transportation planning and integration certain fundamental subjects should be included for all students regardless of their area of specialization. They might include the following:

Transportation Problems: This subject should include an analysis of the development and operation of all types of transportation. It should include the questions of economic, finance, regulation, coordination, and operation. It does not include, however, all the detail normally given in the so-called course in "Economics of Transportation." It presents the generalized engineering problems as well as operative problems in all forms of transportation.

It is the background subject that must provide the student with a broad foundation in all phases of transportation. It must begin to acquaint the student with the direct and indirect effects of transportation upon economics, and types and standards of living. It must be concerned with the transportation problems of the urbanized areas as well as with the commercial forms of transportation.

Transportation Planning: The development of this general subject is perhaps the most difficult of all transportation subjects to present objectively. It follows the analysis of transportation agencies as given in the Transportation Problems course. It analyzes future trends, needed integration, and financial policies, and it places the subject of transportation in its proper relationship to other disciplines and subjects. It gives the student an understanding of future problems and general ways in which they can be attacked or prevented.

At North Carolina State College we have found that this course is most effective as a seminar course which draws very liberally from other disciplines. The students are given an insight into the philosophy of city and regional planning. They are acquainted with the planning approach and with the tools used by the planner. Discussions are held with economists and persons dealing with finance.

Transportation from the point of view of the sociologist and the land economist are discussed. Transportation planning and economic problems are presented by engineers and administrators work-

ing actively in the field. Transportation planning is analyzed from the point of view of municipal and state administrator as to the relationship of transportation to other governmental activities. The philosophies of private versus public responsibility in mass transportation and parking are analyzed.

It is hoped that the end-product of transportation problems and transportation planning courses will be that the student has gained an understanding of the complexities and interrelationships involved in his activities in transportation engineering. It is intended that the planning approach will aid the future engineer in developing new and more efficient concepts that will integrate transportation and provide for a planned transportation system for the future.

Transportation Design: All students should be given a basic course in the elements of transportation design. This subject includes the overall approach to engineering design. Typical elements included in this course are as follows:

Highway Location: alignment, earthwork, soils, drainage, balanced design, economic factors that determine location.

Geometric Highway Design: actual design of intersections at grade, rotary type design, grade separations, and direct access design.

Channelization: basic concepts of the effectiveness of intersection channelization, types of channelization, typical treatments for specialized areas.

Pavement Design: economics of pavement types, theoretical considerations, drainage and soil characteristics.

Urban Subdivision Design: factors that determine the desirable types of urban subdivision layout. This type of design is of considerable importance to the transportation engineer if he is to prevent land subdivisions from becoming future traffic bottlenecks. The characteristics of good subdivision planning are included.

Highway Terminal Facilities: design and location of parking lots and buildings, the elements of shopping center design, the elements of commercial transportation terminal facilities.

Airport Design: elements of the geometrical and structural design of airports, pavements, and layout; factors that determine the location of airports.

Railroad Design: elements of railroad layout with emphasis on terminal and yard facilities. Engineering factors that control railroad design. Basic railroad operating problems as controlled by design.

Other transportation design dealing with specialized urban problems, and with water transportation.

In summary, the transportation design course attempts to give the student an understanding of all types of design as they are related to the specific form of transportation and as they are related to other forms of transportation. Effective highway design is accomplished only with the proper understanding of its relationship with terminal facilities, shopping layouts, other transportation facilities, land economics, and regional planning.

Transportation Projects: The transportation engineer must show creative ability and the ability to carry to successful completion a project of considerable magnitude. This course may be a single extensive project or a thesis depending upon the student's area of specialization. Students majoring in highway design might complete a major design of a limited access highway in an urban area or a project of similar magnitude. The urban traffic student might develop a major thoroughfare plan for a given area; a student interested in research might be given a major project in pavement research, or in transportation economics. This type of activity is a generally accepted type of endeavor for students pursuing advanced work in engineering education, and does not need further discussion.

Transportation Analysis: Within the framework of this rather broad title are included the engineering and correlated approaches to the transportation problem. This course presents the methods and techniques used to obtain the facts and interpret them rationally. It includes accepted and new survey techniques in traffic operations, financial studies, regional planning studies, highway capacity analysis, statistical analysis, as well as techniques used in the non-highway transportation fields. It includes the general limitations and bias of survey methods. It indicates the value and significance of engineering and statistical data.

The use of this course as a required subject for all transportation students is not axiomatic. In some cases, it may be desirable to in-

clude these matters only in the given areas of specialization. In other cases, much of this subject has been covered within the framework of the undergraduate engineering curriculum. It is important, however, that the student gain a firm foundation in the limitations and value of data and in the methods of transportation analysis.

The preceding subjects listed as required for all students in transportation engineering may be subject to argument relative to the necessity for such breadth and scope for students who wish to specialize within a narrow area. In that respect, it might be appropriate to consider the academic approach to engineering education. In civil engineering, the undergraduate does not deal only with civil engineering. Basically the first two or three years of his education are spent in the *core* courses in science and engineering. He is taught first to understand the engineering approach. He is familiarized with essential features in all major engineering disciplines. Finally, in his last two years he is given training in his chosen field. In that field he does not specialize, rather once again he is shown the basic disciplines in all major phases of civil engineering.

Educationally the trend in the undergraduate curriculum is for more basic engineering courses and less specialization. In the same manner the transportation engineer must be given an insight into all phases of transportation and correlated areas. To say that we have developed a traffic engineer, or highway engineer, or other type of transportation engineer when we have given him only the details of his specialty (such as courses in highway design and traffic operations) is not consistent with sound educational philosophies.

Similarly, to argue that the student must get the details of his specialization only and that he will obtain the scope of transportation problems after his education at the university is completed is subject to question. This argument has great validity if we are training a *technician;* however, we are attempting to produce *Professional Engineers.*

Areas of Specialization: Although the scope of this article does not permit outlines of courses in the various areas of specialization, it might be appropriate to discuss briefly one of the areas, that of highway and traffic engineering. In this area there are two general types of specialization. In highway engineering, emphasis will be

placed upon the problems of the state highway departments and of the consulting engineers who work intimately on major highways, freeways, and toll roads. Problems of pavement design, soil engineering, maintenance procedures, limited traffic operations, and financial and economic studies will be covered in detail. In the traffic engineering area, emphasis will be placed upon traffic operations, urban mass transportation, legal and financial problems, surveys and studies, to mention a few of the specialized subjects.

In keeping with the concepts of transportation planning, however, neither of these areas should overlook one vital subject—that of Urban Thoroughfare Planning. Each type of specialization should include a detailed appraisal of municipal and urban planning problems. The relationship of urban thoroughfares to residential development, industrial and business areas, and to planning approaches should be understood by all students in the highway field. The techniques and methods used to estimate the needs of rapidly growing urban areas should be analyzed. The student should have an understanding of the overall urban plan and the relationship of transportation planning to the urban plan.

Too often, the engineering student assumes that the development of a few thoroughfares is the end product of a planned urban area. Too often, the designer does not realize that the urban pattern is changing as new concepts of urban living revise established patterns of business, industrial, and residential location. In summary, detailed engineering consideration should be given to planning problems in all areas of transportation engineering specialization.

Areas of Correlation: Within each of the areas of specialization, opportunity should be afforded for elective courses in correlating fields. The type of courses needed for the various specializations will be variable. For purposes of illustration, however, courses in statistics, city and regional planning, sociology, land economics, government, economics, finance, labor and personnel problems, administration, landscape and subdivision design, hydrology, soil mechanics, structures, and other allied fields should form a part of the educational curriculum in transportation engineering.

General Characteristics of the Program: On the basis of a rather limited experience in the type of curriculum as outlined, it appears

that it should involve approximately a twelve-month academic period. The standard nine-month graduate type of program is not adequate unless a certain portion of the material has been covered in the undergraduate program. Even when this has been accomplished it is difficult to complete the course work and transportation project in the academic year. Thus a twelve-month period is suggested for continuous study. In cases where the advanced student has a part-time assistantship or fellowship, the work can be completed in two years with the equivalent of nine months of course work.

Where possible this procedure is desirable because it enables the student to pursue creative research in the transportation field and the extended period of two years permits the student to schedule and correlate his subject in a better sequence. Obtaining the proper sequence of courses for a concentrated one year graduate program has always been a difficult educational problem.

In terms of the relative emphasis to be given to the various parts of the program, the required subjects and project might occupy from 40 percent to 55 percent of the curriculum, the areas of specialization from 30 precent to 45 percent, and the correlating courses from 15 percent to 30 percent of the curriculum. This breakdown of emphasis is not constant; it would depend upon the type of specialization desired and the undergradaute background of the student.

Transportation Engineering in the Undergraduate Curriculum: Adequately trained transportation engineers who will provide the leadership in this field will be educated primarily in the graduate school program. The Yale University and the University of California graduate programs are an indication of this trend as outlined herein. It is important, however, that certain types of transportation engineering education be incorporated into the undergraduate programs.

There is great need for the trained civil engineer with a working knowledge of transportation engineering. There is need also for men trained in the transportation engineering field who will work with the design and operational techniques. These personnel might be classed as sub-professional employees. The training of these groups should be given consideration in the overall academic approach.

It is difficult to define procedures for undergraduate education because of the two types of civil engineering programs. In one instance all civil engineering students take the same work, except for elective subjects, throughout the four-year program. In the other approach, a definite option system is used where a student may take either transportation, or sanitary engineering, or structural, or construction, or other specialties. Engineering education has not established a pattern relative to the most desirable system. The option system permits the student to obtain more course work in his chosen area while the general program has more breadth and gives the student a better overall picture of the work of the civil engineer. Regardless of the type of operation certain statements of a general nature might be made pertaining to transportation engineering in this area.

In either system, the student will spend less than 10 per cent of his college course time in transportation engineering. The only manner in which this percentage could be increased would be to offer an undergraduate degree in Transportation Engineering. If this was attempted the product of such training would not have taken the basic component parts of civil engineering. To attempt to give a degree in a specialty of this nature without keeping it within the framework of the broad engineering discipline, such as civil engineering, is considered unwise. It is not consistent with the philosophy of engineering education. From a practical standpoint, the student would be trained in such a narrow field that his opportunities for employment would be confined to the speciality. That is undesirable in any undergraduate program.

Whether transportation engineering is taken in a general civil engineering course or via the option system, certain concepts might be followed. Although the amount of course work is limited, these limitations should not prevent a sound program of the "Elements of Transportation Engineering." Many universities give supposed transportation courses in which the subject matter is primarily that of highway pavement construction and highway location design. While these subjects are of some value, training of this type does not present the transportation picture. This type of course as a substitute for transportation engineering is analogous to giving the

analysis of determinate structures as the only structural engineering course for a civil engineer. It is suggested, therefore, that the civil engineer should have a course in the elements of transportation engineering which includes the following subjects:

1. An analysis, however abbreviated, of all transportation types including their development, the role they play in transportation, certain economic and financial trends, operating problems, and probable trends of future activity and importance.

2. The elements of transportation engineering design; design and laboratory exercises should be given in the design techniques.

3. Basic elements of transportation analysis, surveys, etc.

4. A preliminary insight into the problems of transportation planning and integration.

In summary, this course should cover the essential features of transportation engineering. Admittedly this type of activity would be classified as a survey course. It is believed much more desirable than giving a limited depth in a narrow area of transportation engineering. In the case where all civil engineers take this course, a definite goal has been achieved. The young civil engineer who takes employment in structural design may find himself working with perhaps a bridge location for highway purposes. His background in the transportation area will give him some understanding of the fact that the location of a bridge is not determined only by the easiest crossing of the stream, but rather that the bridge is a part of a transportation network which may have its location dictated by other economic and social conditions rather than by the topography of the particular site.

While it is desirable for civil engineering students to have a limited course in transportation engineering there will still be a group of students who will desire activity in fields allied to transportation or in certain operating phases of transportation. They may desire more work in this area in the undergraduate program. In order to give an example of ways that these courses may be made available to these students, certain details of the civil engineering curriculum at North Carolina State College will be discussed.

Within this curriculum all students take a course in the elements of transportation engineering in their third year. The majority of

students have one elective subject throughout the senior year. For those students wishing more work in transportation, certain of the less advanced graduate courses are made available to those students showing interest and ability in this area. A part of basic design course is taken by some students, others have scheduled the transportation problems course, and others have taken the transportation operations or traffic engineering course.

Our limited experience indicates that these students have profited from these courses in terms of a better understanding of transportation problems and increased knowledge in specialized areas. Certain students who have found employment as city engineers in municipalities too small for traffic or transportation engineers have been able to cope with limited transportation problems. As an additional example structural engineering employees have found their knowledge of transportation design to be of considerable aid.

One last phase of transportation engineering education would include training for the sub-professional type of employee in the state highway organizations, the railroads, the municipalities, etc. The training of this type of employee, such as those engaged mainly with traffic signal maintenance and operation, highway design details, and similar operational techniques cannot be included within the engineering educational approach in so far as teaching primarily the details of the specific operation.

In-service training courses within the state highway or municipal organization, or transportation institutes, or so-called "short courses" given at the university should serve in this capacity. These employees are of great importance to efficient transportation operation. Educationally there is much to be accomplished in all phases of the sub-professional education.

Opportunities and Responsibilities in Transportation Engineering: There is little question of opportunities for employment in this area. In the next decade, perhaps 500 or 1000 municipalities will have some form of a traffic or transportation engineering department. State highway departments each year have been enlarging the scope and activity in traffic operations and in transportation planning. Consulting engineering activity has increased. Young ideas and activity in the railroad field are needed.

Transportation planning and intergration will become a more important phase of the municipal, state and federal governments. Traffic and transportation engineers will be found in large industries as well as with public service groups. Transportation engineering will grow in importance because of the inability of non-technically trained men and legislative groups to cope with the problems. With this opportunity there will be heavy responsibility. The educational institution has a fundamental role in this responsibility.

Traditionally, academic endeavors should lead their field. Academic philosophies mold engineering practice. In this era of transportation planning and intergration, the university must make certain that it analyzes present and future transportation problems. It must make certain that its teachings do not attack 1930 or 1940 problems only. It must bring the importance of transportation planning and integration to both engineers and citizens.

It must by research create new techniques to alleviate future problems. It must help to develop more efficient forms of transportation. It must provide leadership in transportation engineering.

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